# RECORD OF DECISION

**CATHERINE MINES and SKAGGS TAILINGS SUBSITES**
**OPERABLE UNIT 05**

**MADISON COUNTY MINES SUPERFUND SITE**
**MADISON COUNTY, MISSOURI**

**Prepared by:**

**U. S. Environmental Protection Agency**
**Region 7**
**901 North 5th Street**
**Kansas City, Kansas 66101**

**SEPTEMBER 2012**

**Approved by:**

**Cecilia Tapia, Director**
**Superfund Division**

**Date** 9/27/12

## TABLE OF CONTENTS

# RECORD OF DECISION

## DECLARATION

SITE NAME AND LOCATION

Catherine Mines and Skaggs Tailings Subsites
Operable Unit 05
Madison County Mines Site
Madison County, Missouri
CERCLIS ID #: MOD098633415

STATEMENT OF BASIS AND PURPOSE

This decision document for OU5 presents the selected remedial action for mine waste at the Madison County Mines site (Site) – Catherine Mines and Skaggs Tailings subsites (OU5 CM&STS). This decision was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act, as amended by the Superfund Amendments and Reauthorization Act, and, to the extent practicable, the National Contingency Plan. This decision is based on the Administrative Record (AR) for OU5 CM&STS. The AR is located at the following information repositories:

Ozark Regional Library – Fredericktown Branch
115 South Main Street
Fredericktown, Missouri 63645

U.S. Environmental Protection Agency
Region 7 Records Center
11201 Renner Boulevard
Lenexa, Kansas 66219

The Director, Division of Environmental Quality, Missouri Department of Natural Resources, concurs with the Selected Remedy as presented in the Proposed Plan. State comments are presented and addressed in the attached Responsiveness Summary.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response actions selected in this Record of Decision (ROD), present a current threat to public health, welfare or the environment. Therefore, the response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment. The Site contains heavy metals, primarily lead, in mine waste associated with the historical lead mining and processing.

DESCRIPTION OF THE SELECTED REMEDY

The U.S. Environmental Protection Agency believes the Selected Remedy for the Catherine Mines subsite, Alternative 3 – Low Permeable Cover, Sediment Excavation, On-site Disposal, and Monitored Natural Recovery (MNR); and the Skaggs Tailings subsite, Alternative 4 – Low Permeable Cap, Excavation, On-site Disposal, and MNR, with a estimated combined present worth cost of $5.9 million, appropriately addresses the current and potential risks to human health and the environment for these

subsites. The remedy addresses human health and ecological risks through remediation of mine waste, soils, sediments, surface water and groundwater. The remedy will also include monitoring surface water, groundwater and sediment as well as establishing institutional controls using environmental covenants with property owners.

OU5 CM&STS is being addressed by this ROD. However, the Site includes six other OUs: 1, 2, 3, 4, 6 and 7. Remedial action for OU3 – Residential Soils was implemented under a September 2008 Interim ROD (IROD), and a ROD was signed for OU4 – Conrad Tailings Pile in September 2011 with remedial action pending. The remaining OUs will be addressed by future RODs for remedial action.

The major components of the Selected Remedy for OU5 CM&STS include the following actions:

- Excavate or grade mine waste, pond sediment, tributary creek sediment as determined necessary, floodplain soils and transition soils to meet the respective cleanup levels.

- Consolidate mine waste in a common repository at each subsite.

- Grade and contour the soil repositories and construct drainage systems that will effectively control precipitation runoff to prevent erosion.

- Construct the cover or cap at each repository to consist of 12 inches of clay, 6 inches of topsoil and vegetation.

- Install a monitor well network consisting of a minimum of four wells at each subsite to monitor shallow groundwater and hydraulic characteristics.

- Develop and implement a monitoring program for groundwater to ensure shallow groundwater is not migrating from the waste piles. The groundwater monitoring program will continue for a minimum of five years.

- Implement monitored natural recovery (MNR) by developing a monitoring program for sediment and surface water in tributaries and creeks downstream from OU5 CM&STS for a minimum of five years to evaluate the effect of natural processes in preventing downstream migration and to confirm MNR results in protectiveness of human and ecological exposure to contaminated sediments. To enhance the successful application of MNR, highly contaminated stream sediment discovered during design sampling will be removed and consolidated under the caps as part of the remedial action. Any remaining stream sediments of concern found during the monitoring period will be addressed under the OU7 – Watershed response action in the future.

- Establish environmental covenants pursuant to the Missouri Environmental Covenants Act (MoECA) through agreements with property owners as institutional controls to prevent activities that could damage the low-permeable caps resulting in exposure of mine waste to receptors. Well drilling in the capped locations and groundwater consumption will also be prevented through the environmental covenants.

- Assess and remediate residential properties including public and child high-use areas along the former aerial tramway; this will be accomplished through the residential property cleanups already in progress under the IROD for OU3.

- Conduct five-year reviews to ensure the protectiveness of the Remedy.

- Conduct scheduled operation and maintenance (O&M) to monitor and make necessary repairs to the cap and drainage systems ensuring the protectiveness of the Selected Remedy.

STATUTORY DETERMINATIONS

The Selected Remedy is protective of human health and the environment, complies with federal and state laws and regulations that are legally applicable or relevant and appropriate requirements for the remedial action and is cost effective. The remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable. Treatment is not used as a principal element because of the waste volume and the lack of demonstrated, effective treatment alternatives. Because the Selected Remedy will result in hazardous substances, pollutants or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of remedial action to ensure that the remedy is or will be protective of human health and the environment.

ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary of this ROD:

- Chemicals of concern and their respective concentrations.
- Baseline risk represented by the chemicals of concern.
- Cleanup levels established for chemicals of concern and the basis for these levels.
- How source materials constituting principal threats are addressed.
- Current and reasonably anticipated future land use assumptions.
- Potential land use that will be available at the Site as a result of the selected remedy.
- Estimated capital, annual operation and maintenance, and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.
- Key factors that led to selecting the remedy.

Additional information can be found in the AR for these subsites.

Cecilia Tapia, Director
Superfund Division

Date 9/27/12

**Record of Decision**

**Catherine Mines and Skaggs Tailings Subsites – Operable Unit 5**
**Madison County Mines Site**
**Madison County, Missouri**

## SITE NAME, LOCATION AND DESCRIPTION

This Record of Decision (ROD) for OU5 – Catherine Mines and Skaggs Tailings subsites (OU5 CM&STS) pertains to remedial actions to address mine waste contamination at the Madison County Mines Superfund site (Site), the associated waterways, and former aerial tramway. It provides background information, summarizes available data driving the Selected Remedy, identifies the Selected Remedy for cleanup and its rationale and summarizes public review and comment on the Selected Remedy.

This ROD is a document that the EPA, as lead agency for the Site, is required to issue to fulfill the statutory and regulatory requirements found, respectively, in section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), 42 U.S.C. § 9617, as amended, and in the National Contingency Plan (NCP), 40 CFR § 300.430(f)(4). The support agency is the Missouri Department of Natural Resources (MDNR). The EPA plans to conduct the remedial action as federal Fund-lead work.

The Site covers Madison County, Missouri, and as a mining site, includes any media impacted by heavy metals related to historical mining and processing activities and offsetting depositional impacts. Madison County is located approximately 80 miles south of St. Louis in southeastern Missouri at the southern end of the Old Lead Belt where heavy metal mining occurred since the early 1700s and industrial mining since the 1800s. The Site consists of all areas within Madison and southern St. Francois Counties that have been impacted by past mining practices, human distribution and migration of the resulting mine waste. The Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) identification number is MOD098633415. A citizen can use the CERCLIS number on the EPA's website to get information on the Site. A glossary of common Superfund terms is included at the end of this document.

This ROD highlights key information from the Remedial Investigation (RI), Baseline Human Health Risk Assessment (BHHRA), Focused Feasibility Study (FS), and Proposed Plan recently released for OU5 CM&STS. These and other documents are available for additional information regarding the upcoming remedial action in the AR located at the addresses listed below:

Ozark Regional Library
Fredericktown Branch
115 South Main Street
Fredericktown, Missouri 63645

Hours: M, W, T, F: 10:00 a.m. – 5:30 p.m.
Tuesday: 10:00 a.m. – 8:00 p.m.
Saturday: 10:00 a.m. – 3:00 p.m.

U.S. Environmental Protection Agency
Region 7 Records Center
11201 Renner Boulevard
Lenexa, Kansas 66219

Hours: Monday – Friday: 8:00 a.m. – 5:00 p.m.

## SITE HISTORY AND ENFORCEMENT ACTIVITIES

**Activities leading to current problems**: Lead ore was discovered in the area of Mine La Motte (north of Fredericktown) by French explorers around 1715. The area was already known to and likely was being exploited by local Native Americans. Mining commenced in the early 1720s and continued intermittently on a comparatively small scale through the 18th century. Mining and beneficiation activities increased significantly at Mine La Motte and what is now known as the Madison Mine beginning in the mid-1840s and expanded throughout Madison County in the period following the Civil War. Most of the smaller mines located around the county were operated at that time. Mining in Madison County has produced copper, lead, cobalt, nickel, iron and small amounts of zinc, silver and tungsten.

Past mining operations have left at least 13 identified major areas of mine waste in the form of tailings and chat deposits from significant mineral processing operations and smelting in Madison County (Figure 1). Chat deposits include sand- to gravel-sized material resulting from the crushing, grinding, and dry separation of the ore material. Tailings deposits include sand- and silt-sized material resulting from the wet washing or flotation separation of the ore material. The mine waste contains elevated levels of lead and other heavy metals which pose a threat to human health and the environment. These deposits may have contaminated soil, sediments, surface water and groundwater. These materials also may have been transported by wind and water erosion or manually relocated to other areas throughout the county. Mine waste and soils contaminated as a result of mine waste erosion were reportedly used on residential properties for fill material and private driveways, used as aggregate for road construction and placed on public roads around Fredericktown to control snow and ice in the winter.

**Federal, state and local site investigations; removal and remedial actions**: Starting in 1980, a number of investigations by various organizations were conducted on the county's mine waste and its effects, most of which focused on the areas affected by mine waste within OU2 (Anschutz). To investigate a broader area, the EPA performed an Expanded Site Inspection (ESI) on the Little St. Francis River (LSFR) watershed at the Site in 1995. The ESI attempted to identify potential sources of mine waste in the LSFR watershed, determine the composition of these sources and determine if there had been a release of mining-related contaminants (heavy metals) to media within the LSFR watershed. Geographically, the ESI included OU1 (Northern Madison County Unit), OU2 (Anschutz) and the Catherine Mines, Skaggs Tailings and Conrad mine waste areas designated at that time as OU3. A limited number of samples were collected from mine waste, groundwater, sediment and soil and were analyzed for heavy metals. The results indicated elevated concentrations of a number of heavy metals. Additionally, studies conducted by the Missouri Department of Health and Senior Services (MDHSS) and the Madison County Health Department (MCHD) concluded that some children in Madison County had elevated blood lead levels.

As a result of the elevated blood lead levels in children, the presence of mine waste piles in Madison County and previous investigations, the EPA began conducting removal assessment activities at the Site, focusing on lead-contaminated surface soil in residential yards and other areas frequented by children referred to as child high-use areas. The removal assessment consisted of obtaining access to residential yards or public areas, documenting current property conditions, collecting surface soil throughout the property and analyzing the samples for metals with a portable X-Ray Fluorescence (XRF) instrument.

Because assessment results in the Harmony Lake area indicated children's health was at risk due to lead levels in residential surface soil, an Action Memorandum was signed by the EPA in September 2000,

outlining the rationale for implementing a removal action in the Harmony Lake area. The removal action consisted of excavating the soil in areas with elevated lead concentrations up to one foot below ground surface (bgs) and two feet bgs in garden areas and replacing it with clean soil. Additionally, the approximately 30-acre Harmony Lake tailings pile was covered with one foot of soil to stabilize the mine waste and minimize its impact on human health and the environment.

In 2002, at the request of the MCHD, the EPA tested mine waste recently brought in to be used as fill at a farm supply company in Fredericktown. Upon confirming elevated concentrations of metals—particularly lead in the mine waste fill at the property and upon confirming at least one child living nearby with an elevated blood lead level (greater than 10 micrograms per deciliter [µg/dl]), the EPA signed an Enforcement Action Memorandum in August 2002. A removal action was conducted by Madison County Farm Supply under a Unilateral Administrative Order and included removing all mine waste and contaminated soil with lead concentrations greater than 400 parts per million (ppm) from the Farm Supply property and transporting the mine waste back to its original location, currently called the OU3 LSFR subsite.

The EPA executed another Action Memorandum in September 2002 to minimize human exposure to lead-contaminated soil in sensitive populations at child high-use areas such as daycare centers, public parks, other public recreational facilities and homes with potential lead-impacted children in Fredericktown and northern Madison County. Beginning in March 2003, removal actions were again implemented similar to those performed at Harmony Lake to address the lead-contaminated soils. The Catherine Mines subsite was used as a soil repository for this removal action. When the removal actions were completed in October 2006, over 800 residential properties which included daycare centers, schools, churches, and mobile home parks and child high-use areas had been remediated, and approximately 205,000 cubic yards ($yd^3$) of lead-contaminated soil had been transported from residential properties to the repository at the Catherine Mines subsite.

As part of the removal assessment, the EPA also collected and analyzed a limited number of surface water and sediment samples across the Site. Results of this sampling, in addition to the ongoing residential property surface soil sampling, confirmed lead and various other heavy metals at concentrations in excess of their respective background concentrations. Surface water was also sampled revealing concentrations of iron, lead, nickel, aluminum, copper and silver exceeding the MDNR's aquatic life standards. As a result of the human impact and the presence of elevated levels of heavy metals, the Site which currently includes seven OUs, was placed on the National Priorities List (NPL) on September 29, 2003.

The Madison County Mines Remedial Investigation (RI) Report that included OU3, Residential Soils; OU4, Conrad Tailings; and OU5 CM&STS was issued on April 2008. An Interim Record of Decision (IROD) for OU3 was issued in July 2008, and remedial action for continuing the cleanup of residential properties including child high-use areas was implemented in October 2008. Residential soils are being transported to the Conrad tailings pile for use as a soils repository, and, to date, over 400,000 cubic yards of soil and mine waste has been transported as the result of the OU3 remedial actions. The combined removal and remedial actions to date have resulted in over 4,000 residential properties sampled for metals and over 1600 residential properties remediated.

The Focused FS report for OU4 was completed in 2011, and a ROD was completed in September 2011. The remedial action for OU4 is pending. The FS for OU5 was completed in June 2012, and the Proposed Plan was presented to the public on July 24, 2012, with all supporting documents included in the AR.

## COMMUNITY PARTICIPATION

Since 1999, the Madison County Environmental Roundtable has been meeting bimonthly to discuss the health and environmental concerns related to the Site. These meetings have included representatives from the EPA, MDNR, MDHSS, MCHD, the Agency for Toxic Substances and Disease Registry, elected officials of Fredericktown and Madison County, news media, visiting academia and students and local citizens. A health education program involving all stakeholders provides proactive forums to educate the community on health issues including prevention of lead exposure, safe handling practices, in-home lead assessments and child blood lead testing.

The public was encouraged to participate in the Proposed Plan process in development of this ROD. The Proposed Plan highlighted key information from the RI Report, FS Report, Baseline Human Health Risk Assessment (BHHRA), Ecological Risk Assessment (ERA) and other supporting documents in the AR. Additionally, the public historically has been made aware of the environmental issues in the county through fact sheets, public availability sessions and press releases during the previous removal and remedial cleanups that have occurred and continue at the Site. To provide the community with an opportunity to submit written or oral comments on the Proposed Plan for OU5, the EPA established a 30-day public comment period from July 19 to August 19, 2012. The notice of availability of the AR file and the Proposed Plan was published in the Democrat News on July 19 and 21, 2012.

A public meeting was held on July 24, 2012, at 6:30 p.m. at the Black River Electric Cooperative in Fredericktown, Missouri, to present the Proposed Plan, accept written and oral comments and answer any questions concerning the proposed cleanup. The EPA also used the public meeting for OU5 to talk about the ongoing residential cleanup and other details concerning provisions of the Proposed Plan, including conversations with the property owner of the Catherine subsite to facilitate establishing environmental covenants with property owners to be included in the ROD. A total of 18 local residents, a property owner, representatives of two companies, and local, state and federal government officials attended the public meeting. A transcript of the public meeting has been included in the AR. A summary of questions received at the public meeting and the responses is provided in the attached Responsiveness Summary. The Responsiveness Summary also contains a summary of written correspondence received during the public comment period and the EPA's written responses to public comments.

## SCOPE AND ROLE OF THE RESPONSE ACTION

The EPA's overall strategy is to remove soils at residences and child high-use areas that contain soils contaminated with lead above 400 ppm, and transport them to repositories within Madison County already containing mine and mill wastes. The residential yards and child high-use areas are backfilled with clean soil, vegetated and will have a marker barrier placed at 2-feet depth if the remaining lead concentration exceeds 1,200 ppm to warn residents of the presence of residual contamination. See the Site's History and Enforcement Activities for a description of prior response actions.

The Selected Remedy for this ROD presents the EPA's approach to address OU5 C&STS that includes consolidating perimeter mine waste and soil, floodplain soil and sediment in ponds with mine waste and covering the consolidated wastes with protective caps. MNR of surface water and sediment in streams will be implemented to ensure that future clean sediment deposition will prevent exposure and downstream migration of contaminants. Environmental covenants pursuant to MoECA will prevent damage to the caps, drilling of wells and consumptive use of groundwater.

The Site has been divided into seven OUs (see Figure 2) to organize the work into logical elements based on similar contaminated media, geographic and demographic features of the Site, and setting priorities for the work. The final decisions on cleanups for the other OUs will be issued in the future as RODs under remedial authority. The seven OUs are described in detail as follows:

- OU1 is located in northern Madison County and consists of the Mine La Motte Recreation Association (MLMRA) that contains approximately 250 acres of tailings; the Slime Pond (a 100-acre lake that adjoins the MLMRA); the Harmony Lake area; the Copper Mines mine waste; the Old Jack Mine; the Lindsey Mine; the Offset Mine, the small gage feeder rail right-of-way to the abandoned Black Mountain spur; and all other areas affected by these mining activities.

- OU2 is located immediately southeast of Fredericktown and includes the A, B, C, D and E Tailings Areas (historically called the Madison Mine); the metallurgical pond; remnants of an old mill and smelter; head frame and abandoned shafts; a mine decline; a refinery complex; a chat pile; the abandoned Black Mountain spur right-of-way through Fredericktown; and all other areas affected by these mining activities.

- OU3 includes all residential properties including public areas in Madison County as well as the entire cities of Fredericktown, Junction City, Cobalt Village and the LSFR tailings. Within and around the cities and the LSFR area, OU-3 also includes all streets, road right-of-ways, public drainage ways, possible smelter stack and mine waste pile wind-blown contamination, groundwater, surface water and sediments in Goose Creek and Tollar Branch, and mine works locations and outflows.

- OU4 includes the entire Conrad tailings pile and associated mine waste of the adjoining Ruth Mine and Mill complex, surface water and sediments affected by the mine waste, eroded materials to the LSFR from the mine waste source location, road right-of-ways and public drainage ways, possible smelter stack and mine waste pile wind-blown contamination, groundwater impacts, and mine works locations and outflows.

- OU5 includes the Catherine Mines and Skaggs Tailings subsites with mine waste, soil, pond sediment, and groundwater and residential properties affected by a former overhead tram from the Catherine Mine to the LSFR tailings. OU5 also includes surface water, floodplain soil, sediment and groundwater affected by the Catherine and Skaggs mine waste as well as nearby mine works' locations and outflows.

- OU6 includes all other known and undiscovered mining-related contaminated areas including but not limited to the Silver Mines area, nearby groundwater, surface waters and sediments in the unnamed runoffs to the LSFR, road right-of-ways, public drainage ways and mine works locations and outflows.

- OU7 includes impacted drainages, tributaries, creeks and rivers from mine waste within the LSFR watershed.

Under the Selected Remedy, OU5 CM&STS is the third OU to be addressed under remedial action. The approach by the EPA at the Site has been to address the higher risks areas first. The EPA has already selected a remedy for a portion of OU3 with an Interim Record of Decision (IROD) signed in 2008 for residential property soils to address cleaning up areas posing the greatest and most immediate threats to

human health by removing contaminated soil and transporting it for capping at the Conrad repository. This is a continuation of residential property actions implemented in Madison County with removal actions beginning in 2000. The final actions for OU3 will include the remaining portion of the LSFR tailings, public right-of-ways, easements and drainage ditches and will be addressed by a final ROD for OU3. These OU3 actions will be addressed in the future since there is less overall human health risk associated with them. The EPA has also selected a remedy for OU4 – Conrad Tailings with a ROD completed in September 2011, to address mine waste at the tailings pile which is also used as a residential soils repository. The remedy for OU4 also addresses groundwater, associated downstream impacts to sediment, floodplain soils and overbank deposits, surface water in the unnamed tributary to Mill Creek and the affected soils along County Road 200.

A Supplemental Remedial Investigation/Focused Feasibility Study (RI/FS) has been performed for OUs 1, 2, 3, 5 and 6. The Supplemental RI did not include any additional assessment of OU5 so a separate FS was conducted for OU5. The RI/FS for the remaining OUs are ongoing. OU7 is scheduled as the last remedial action for the Site to address human health and environmental exposures to contamination related to the stream systems that will not be addressed by remedial actions under the other OUs. The final OU7 remedial actions will be supported through a Watershed Master Plan for community involvement and acceptance.

This ROD describes the selected approach by the EPA to address OU5 CM&STS. Additional investigation is planned during the Remedial Design/Remedial Action (RD/RA) phase to more fully characterize the overall extent of contamination in the transition soils outside the mine waste piles and at former mine/mill locations, and in and along the associated water courses for the purpose of supplementing construction design, determining final costs, and determining the extent of monitoring necessary to document the natural recovery of downstream sediments.

## SITE CHARACTERISTICS

**Conceptual Site Model:** A conceptual site model (CSM) for human exposure pathways to heavy metals resulting from mine waste at the Site is included as Figure 4. It should be noted that although the CSM covers all anticipated exposure at the Site, this ROD is focused on addressing OU5 with mine waste as the source material which has impacted surface soils, sediment in ponds and water courses, surface water, and groundwater. Residential properties determined impacted along the path of the former aerial tramway are being assessed and remediated in the response actions associated with the OU3 IROD – Residential Soils.

**Size of Site/Geographical and Topographical Information:** The Site covers all of Madison County, Missouri, as depicted in Figures 1 and 2, which is approximately 498 square miles. OU5 CM&STS is located approximately two miles north and west of Fredericktown along Highway 67, adjacent to and west of Highway H in Sections 1 and 2, Township 33N, Range 6E, Madison County, Missouri. It consists primarily of four remnant chat and tailings deposits covering approximately 27 acres that includes approximately four acres of sediment and floodplain soil in ponds and associated tributaries and creeks. It also includes an estimated two-mile pathway of a former aerial tramway that was used for transporting development rock from the Skaggs Tailings subsite to a former mill located to the southeast along the LSFR.

**Surface and Subsurface Features:** Madison County is subdivided into the St. Francois Mountains on the western side and the Salem Plateau on the eastern side of the county. Topographically, the

St. Francois Mountains comprise a geologically mature landscape with rounded ridges and meandering streams that occupy comparatively wide valleys. In a few locations, rivers and streams cut across ridges, forming steep canyons.

Much of the Site is underlain by Paleozoic (Cambrian) sedimentary rocks that rest on Precambrian crystalline rocks or basement complex which form the St. Francois Mountains. The sedimentary formations vary in thickness and locally thin out or pinch out against structural highs of the basement complex (St. Francois Mountains). The rock formations present in the area include the following from the Precambrian basement: (1) the Lamotte Sandstone, (2) the Bonneterre Dolomite, (3) the Davis Formation, and (4) the Derby-Doe Run Dolomite. Soil formed from these formations is predominantly clays with comparatively low permeability. Soil profiles and horizons are generally well developed.

Most lead mineralization in the Madison County area occurs within the lower part of the Bonneterre Dolomite on the flanks of buried or exposed Precambrian topographic highs, generally within a few hundred feet of the boundary where the underlying Lamotte Sandstone pinches out. Lead ore, primarily in the mineral galena, and other metallic minerals occur as deposits that have replaced dolomite crystals in portions of the Bonneterre Dolomite. The ore occurs in horizontal sheets along bedding planes, cavity fillings and linings on the walls of joints and fractures. The deposits extend laterally for hundreds of feet and may extend 200 feet vertically. However, mineralization in the Silver Mines area is distinct, consisting of quartz veins in the Precambrian basement complex that contain galena, wolframite (iron tungstate) and additional sulfide minerals as primary ore phases for additional metals such as tungsten and silver.

Surface drainage generally flows northerly at the Catherine Mines subsite to the Highway H right-of-way ditch and northwesterly to the Catherine Pond. Both the ditch and pond discharge to Logtown Branch Creek (Logtown Branch); the south portion of the site drains southeasterly to an unnamed tributary to Plum Creek. Surface drainage at the Skaggs Tailings subsite generally flows easterly to an unnamed, intermittent tributary that enters the LSFR approximately one mile to the southeast, and to a small pond at the southeastern side of the property. Visible chat is present in drainage ditches on-site of the OU5 CM&STS, but limited evidence of a physical presence of chat is observed in the downstream tributary and creeks possessing sediment and floodplain contamination. Figure 3 shows the features of OU5 CM&STS.

**Sampling Strategy:** Sampling was conducted to provide for the overall characterization of contamination at OU5 CM&STS and includes the following:

- Chat and tailings samples were collected in the tailings piles at each OU5 subsite that included five-foot core and hand auger samples collected and analyzed for total metals. Sample results for total metals included a range of detections in parts per million (ppm) for arsenic (7.1–40.5 ppm), cobalt (72.6–280 ppm), copper (32.4–1,050 ppm), lead (1,420–28,400 ppm), manganese (1,990–4,200 ppm) and nickel (82.7–296 ppm). Chat and tailings samples were also analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) method pursuant to the Resource Conservation and Recovery Act (RCRA) and stated in regulations at 40 CFR § 261.24 exceeding the metals toxicity limit of 5 milligrams per liter (mg/l) for lead at concentrations ranging from 36.8 to 105 mg/l.

- Soil samples were collected in transition soil located around the outside perimeter of the mine waste deposits. Nine of nine samples in the transition soil surrounding the Catherine Mines

subsite did not exceed the EPA Region 7's Preliminary Remediation Goal (PRG) of 400 milligrams per kilogram (mg/kg) for residential properties. However, five of 10 soil samples collected outside the Skaggs Tailings subsite in the transition soil exceeded the residential PRG and/or background concentrations, with maximum concentrations for lead (4,490 ppm) , arsenic (14.9 ppm), cobalt (135 ppm), copper (574 ppm), nickel (137 ppm) and manganese (4,600 ppm). Floodplain soils possessed the following maximum concentrations: Arsenic (17.3 ppm), cobalt (69.7 ppm), copper (80.2 ppm), lead (1,410 ppm), manganese (5,980 ppm) and nickel (71.1 ppm).

- Groundwater sampling across the Site has revealed a very limited incidence of groundwater contamination. Groundwater contamination at OU5 CM&STS is projected to be limited to shallow groundwater contained within the waste pile locations. There is no known use of groundwater in the immediate vicinity of OU5 CM&STS. Shallow groundwater sampled in the mine waste piles and analyzed for dissolved targeted metals revealed low-to-moderate concentrations for arsenic in five samples ranging from below detection limits to 18 micrograms/Liter (ug/l) and in four samples for lead ranging from 22.3 to 61.3 ug/l. For comparison, these concentrations exceeded the EPA Maximum Contaminant Level (MCL) of the Safe Drinking Water Act (SDWA) for arsenic (10 ug/l) and the federal action level for lead (15 ug/l).

- Surface water samples were collected from drainage ditches on-site and creek tributaries leading from the mine waste deposits. All water quality standards (WQS) set by the state of Missouri, approved by the EPA pursuant to the Clean Water Act, were met in water sample results collected in conjunction with the Catherine Mines subsite. However, one sample collected from the Skaggs Tailings subsite revealed lead detected at 16.4 ug/l, exceeding the WQS of 2.5 ug/l.

- Sediment samples collected at OU5 CM&STS exceeded the human health risk indicators with detections of the following metals' maximum concentrations: Arsenic (34.5 mg/kg), cobalt (154 mg/kg), lead (5,880 mg/kg), and manganese (17,600 mg/kg). Copper, lead and nickel exceeded ecological risks, predicted in terms of sediment toxicity, with their respective concentrations of 239 ppm, 5,880 ppm, and 206 mg/kg.

Additional sampling is planned during the RD/RA phase due to the relative instability of the mine waste potentially resulting in continued migration prior to implementation of remedial action.

**Type of Contamination and Affected Media and Sources of Contamination**: Past mining operations have left mine waste deposits containing elevated concentrations of various metals, but lead, arsenic, cobalt, copper, manganese and nickel were identified as the Chemicals of Concern (COCs) for OU5 CM&STS. For additional information, see the Conceptual Site Model in Figure 4.

**Quantity and Volume of Waste:** The total estimated quantity of mine waste present is estimated to slightly exceed 318,000 cubic yards which includes approximately 109,000 cubic yards of original tailings and chat. An additional estimated 205,000 cubic yards of soil from the time-critical removal actions were transported from residential properties to the Catherine Tailings subsite used as a contaminated soil repository. These lead-contaminated soils were transported from residential properties

and placed on top of tailings near the pond. The estimated quantity of sediment in two ponds is 4,100 cubic yards. The volume of shallow contaminated groundwater in the waste piles has not been estimated.

**Chemicals of Concern (COCs) Concentrations:** The ROD focuses on lead, arsenic, cobalt, copper, manganese and nickel as the primary COCs in soil, sediment, floodplain soil, surface water and groundwater. The concentrations of the COCs detected in these media are described in the Sampling Strategy earlier in this section.

**RCRA Hazardous Wastes**: Lead and arsenic are D-listed hazardous waste constituents pursuant to the Resource and Conservation Recovery Act (RCRA) as set forth in 40 CFR § 261.24. Both are classified by the EPA as probable human carcinogens and are cumulative toxicants. In 1980, RCRA was amended by adding section 3001(b)(3)(A)(ii), known as the Bevill Exclusion, to exclude "solid waste from the extraction, beneficiation, and processing of ores and mineral" from regulation as hazardous waste under Subtitle C of RCRA. This exclusion was intended to exclude from RCRA low toxicity, high volume waste which led to the exclusion of 20 mineral processing wastes at 40 CFR § 261.4(b)(7) from RCRA which includes slag from primary lead processing.

**Location of Contamination and Known or Potential Routes of Migration**: Mine waste chat and tailings remain present at the locations placed during mining in addition to offsetting locations where mine waste has migrated as a result of wind erosion, water erosion and human transport. Groundwater contamination is extremely limited across the Site and is projected to be limited to the shallow subsurface within the waste piles at OU5 CM&STS. There is no known vertical and lateral migration of contaminated groundwater outside the waste piles; migration is not anticipated due to the neutralization effect of the highly alkaline surface and subsurface limestone and dolomite rock. Known and potential routes of migration include surface water eroding mine waste and loading of COCs to the on-site drainage ditches leading to creek tributaries at the north, south and east side of OU5 CM&STS. Figure 3 illustrates the general location of contamination at OU5 CM&STS but does not depict the extent of contamination in and along the tributaries and creek.

**Current and Potential Routes for Human and Environmental Exposure**: Ingestion of metal-contaminated soil and water is the primary route of exposure to COCs by both humans and ecological receptors. Inhalation of metal-contaminated dust from the waste piles and surface soil is also identified as an exposure route for humans but constitutes a lower risk based on site specific characteristics, land use and human activity. Tables 1-2 and 1-3 show the exposure pathways and receptors. Additional detail concerning exposure pathways and receptors can be found in the Summary of Site Risks.

**Lateral and Vertical Extent of Contamination**: Mine waste is present in the form of chat and tailings as illustrated in Figure 3 with average depths ranging from four to eight feet and pinching out to the surface at the perimeter of each pile. Offsetting soil contamination will be defined during the RD for the transition soils in addition to locations around other mine/mill works locations that may not be identified in Figure 3. Downstream impacts are present in the tributary creek channels and associated floodplains and will also be further delineated during the remedial design (RD).

**Likelihood for Migration of COCs**: The organic form of lead is generally unstable and undergoes rapid conversion to inorganic lead compounds. Most forms of inorganic lead are relatively insoluble, tend to bind tightly to soil, and are not highly mobile. The migration of mine waste at OU5 CM&STS is predominantly associated with physical transport resulting from water erosion and, to a lesser degree,

wind erosion and transport. Two ponds, one each at each subsite, have minimized transport by water erosion to Logtown Branch and the southern-most tributary. The natural increase of vegetation has also minimized water erosion of the chat and tailings. A large portion of the mine waste present at the Catherine Mines subsite was covered with residential soils during the mid-2000s; the majority of residential soils transported to the subsite were then covered with a clean soil and rock increasing the stability of the repository. Groundwater contamination is present only in the mine waste piles; horizontal and vertical migration is considered unlikely due to the presence of alkaline, carbonate-rich limestone and dolomite bedrock serving as buffers inhibiting lead solubility and minimizing leaching. Migration of contamination in surface water is mostly limited to solids transported by erosion or in the form of groundwater seeping from the sides and base of the waste piles to the on-site drainage ditches. Similar to groundwater, surface water interacting with the surrounding alkaline carbonate rock neutralizes an otherwise acidic condition resulting from the production of sulfuric acid due to the degradation from atmospheric exposure of lead sulfides and is thereby minimized.

**Human and Ecological Populations that could be Affected:** The populations that could be affected are discussed in the Summary of Site Risks and are included in Tables 2-1 and 2-2.

## CURRENT AND POTENTIAL LAND AND RESOURCE USES

Since mining operations have ended in Madison County, the primary land use is agriculture crop and pasture land. Industrial activities consist of light manufacturing, aggregate production, and construction. The population is predominantly rural. According to 2010 census data, the population of Madison County is 12,226 including 4,857 households, and 5,929 housing units. In addition, the county has approximately 260 nonfarm businesses, 6 schools, 400 farms, 300 miles of unimproved rural roads, 100 miles of paved rural roads, 1 major river, 1 secondary river, and 1 water supply district. The city of Fredericktown draws its water supply from the LSFR. The Madison County Public Water Supply District (PWSD) provides water to rural customers from wells located north and south of Fredericktown, and rural residents not served by the PWSD are supplied by their own private wells.

**Current On-Site Land Uses**: Property at OU5 CM&STS includes uses for agriculture, commercial trucking operations that includes maintenance buildings and an office, an inactive commercial rock quarry, active aggregate staging/stockpiling, and for recreation. A water tower and a phone tower are present on the Skaggs Tailings Subsite. Surface water in the tributary leading to the small pond and the pond on the Skaggs Tailings Subsite is used for stockwater; surface water in the Catherine Pond is used for recreational purposes. There is no known beneficial use of groundwater at OU5-CM&STS, and the associated tributaries and creeks are assumed to be used for agriculture and recreational purposes. The former tramway traveled above property that is mostly forested and used for agriculture, residential and county roads and state highway with their right-of-ways.

**Current Adjacent/Surrounding Land Uses:** Properties adjacent to the site include uses for residential, agriculture, logging and a county maintenance shop.

**Future Property Use**: The current property owner of the Catherine Mines subsite has expressed a desire for future residential development of the property considering its rural setting, close proximity and ready accessibility on improved and maintained roadways to the city of Fredericktown. The property owner for the Skaggs Tailings subsite expressed a desire to use the area at and in close proximity to the chat piles for unspecified commercial purposes. There is no anticipated change of the property use related to the former tramway related to the Skaggs Tailings subsite, but residential or commercial development

could occur over time. There is no anticipated consumptive use of groundwater on the OU5 CM&STS properties. The EPA will be seeking environmental covenants pursuant to MoECA from each property owner to protect the capped and immediate surrounding areas at OU5 CM&STS from being used for residential development. Additional land at both subsites is anticipated to be opened for productive use once the remedy is in place.

**Potential Beneficial Ground/Surface Water Uses**: Surface water in the small pond on the Skaggs Tailings subsite will continue to be used for stockwater, and the pond on the Catherine Mines subsite will continue to be used for recreational purposes.

## SUMMARY OF SITE RISKS

The basis for the response action at OU5 CM&STS is the presence of site COCs at concentration levels that result in a noncarcinogenic hazard index greater than one and a carcinogenic risk greater than one in a million, using reasonable maximum exposure assumptions for reasonable anticipated land use at or near the mine waste deposits. Another basis for the response action is the adverse environmental impacts that are caused by the site contaminants if no response action is conducted. Chemicals of potential concern (COPCs) were identified through physical sampling of mine waste, soils, sediment, surface water and groundwater impacted from the presence and migration of mine waste.

Shallow groundwater in the waste piles exceeds the EPA's MCLs of the SDWA for arsenic and federal action level for lead at OU5 CM&STS. MCLs were promulgated pursuant to the SDWA to protect human health from the consumption of contaminated drinking water. Surface water at the Skaggs Tailings subsite exceeded the WQS for lead. Numerical or narrative WQS are established to protect the state's waters "designated use" such as recreation, protection and propagation of fish and aquatic life, agriculture and industrial uses, public water supply and navigation within the state's boundaries.

The EPA completed an Ecological Risk Assessment (ERA) in 2006 and a BHHRA in 2007. Additional ecological risk characterizations were completed by the EPA in 2010, and additional human health risk characterizations were completed in 2008 and 2012, all of which are included as part of the BHHRA and ERA and are available for public review in the AR. The EPA has established Preliminary Remediation Goals (PRGs) for the Site, identified in the Remedial Action Objectives section, based on the risk data and has determined that COCs present in mine waste, soil, sediment and surface water OU5 CM&STS exceed those numerical values.

### Chemicals of Concern

The EPA identified the principal risks to human health and the environment associated with six metals identified as the COCs which are: Arsenic, cobalt, copper, lead, manganese and nickel. Ecological risks are primarily associated with aquatic biota and terrestrial vermivores. The primary threat to human health is caused by exposure to lead, which has been determined to exist in elevated concentrations in the presence of the other COCs.

### Primary Exposure Route

Ingestion of metal-contaminated soil and water is the primary route of exposure to COCs by both human and ecological receptors. Inhalation is also identified as a human exposure pathway but constitutes a lower risk at OU5 CM&STS based on site-specific characteristics, land use and activity.

**Summary of Human Health Risk Assessment**

The 2007 BHHRA and supplemental risk assessment data was used to develop the PRGs discussed in the Remedial Action Objectives section. The BHHRA identifies the known and potential risks to humans, both now and in the future, from site-related contaminants present in environmental media including surface soil, dust, sediment, surface water, groundwater and fish tissue. The BHHRA assumes that no steps are taken to remediate the environment or to reduce human contact with contaminated environmental media.

**Exposure Assessment**

The BHHRA and supporting risk documents identifies the following receptors and exposure pathways for quantitative assessments of the risks to human receptors at OU5 CM&STS:

- Future Residents: Ingestion of and direct contact with surface soils combined with hypothetical future ingestion of shallow groundwater near the mine waste.
- Commercial Workers: Ingestion of and direct contact with surface soils combined with hypothetical future ingestion of shallow groundwater near the mine waste.
- All Terrain Vehicle (ATV) Riders: Ingestion, inhalation and dermal exposure to mine wastes and surface soils.
- Adult Recreational Visitor: Ingestion of and dermal exposure to floodplain surface soil, sediment, surface water and ingestion of locally caught fish.
- Child Recreational Visitor: Ingestion of and dermal exposure to floodplain surface soil, sediment, surface water and ingestion of locally caught fish.

**Land and Groundwater Use Assumptions**

Shallow groundwater near the mine waste could be used for drinking water purposes in the future. Recreational activities such as ATV riding over mine waste and fishing in the Catherine Mines subsite pond have been observed in the past. Future construction will likely occur at the subsites resulting in exposure to COCs by construction workers. Residential and commercial development may occur at or near the mine waste areas. Use of mine waste as construction grading and fill material, in addition to use for spreading on roads for traction during deicing operations, could occur.

**Toxicity Assessment**

Assuming no response action to address COCs is performed at the OU5 CM&STS, the risks based on toxicity characterization are as follows:

- If shallow groundwater near the mine waste areas was used for drinking water purposes in the future, children ingesting groundwater at both the Catherine Mines and Skaggs Tailings subsites would result in a noncancer risk exceeding modeled P10 values of 5 percent. A P10 value of 5 percent is the EPA's health-based goal using the IEBUK model to determine and set the lead level for soil and other media to limit exposure such that a typical (or hypothetical) child or

group of similarly exposed children would have an estimated probability of no more than 5 percent of exceeding a 10 micrograms/deciliter (ug/dl) blood lead level, considered an elevated blood lead level (EBL).

- Future pregnant construction workers who ingested soil and shallow groundwater at the Catherine Mines subsite would result in blood lead levels exceeding the P10 value of 5 percent.

- A child visiting the subsites as a recreational visitor may experience a slightly elevated blood lead level; the probability of a recreational child visitor experiencing a blood level above 10 ug/dl is 9 percent, which slightly exceeds the EPA's health-based goal of 5 percent.

- Primarily, because of exposure to manganese via the route of drinking shallow groundwater in the future in addition to routes of ingestion, inhalation, and dermal exposure to soil and mine wastes, noncancer risks are above a level of concern for ATV riders at both subsites. Risks from lead exposure to ATV riders exceed the P10 value of 5 percent.

**Human Health Risk Characterization**

Exposures to lead were assessed separately from the other identified COCs through the use of the IEUBK Model for the OU3 IROD which is part of the AR. Human exposure to lead is consistent across the Site and is relevant to OU5 CM&STS. The risk assessment identified potential health risks for children, adults and human fetuses who live on and near mill wastes and who also consume garden produce. The assessment showed an unacceptable risk for people living on soils or mine waste impacted with lead above 400 ppm and for shallow groundwater use, near the mine waste area, exceeding the federal action level for lead of 15 mg/L. Please refer to the BHHRA and supplemental documents in the AR and the Conceptual Site Model under the Site Characterization section displaying a flow chart of the general site risks.

**Summary of Ecological Risk Assessment**

**Chemicals of Concern (COCs)**: Arsenic, cobalt, copper, lead manganese and nickel in soil, sediment, and surface water are the COCs. Concentration ranges are presented in the Sampling Strategy under the Site Characteristics section.

The EPA completed an ERA in 2006. Additional ecological risk characterizations were completed by the EPA in 2010. The purpose of the ERAs was to describe the likelihood, nature and severity of adverse effects that environmental chemical contamination may be having on local ecosystems. The information is used by the EPA to make decisions on whether remedial activities are needed at the site to protect the environment.

Risks to soil function were assessed by comparing COC concentrations to toxicity benchmarks from the literature for plants, earthworms and other soil invertebrates. Comparisons to phytotoxicity reference values indicate that most mine-impacted soils contain COCs at concentrations that could be expected to adversely affect plant growth. Comparisons to conservative toxicity benchmarks for earthworm and other soil invertebrates in the evaluation indicated that mining-related soils contain COCs at concentrations that could be expected to adversely affect earthworm and other soil invertebrate populations.

The analysis evaluated risk to terrestrial receptors by comparing COC concentrations in soil to ecological soil screening levels for specific feeding guilds (herbivores, vermivores, and carnivores) within the terrestrial environment. Comparisons to the feeding guilds' specific screening levels in the evaluation indicated that mining-related soils contain COCs at concentrations that could be expected to adversely affect populations of terrestrial vertebrates.

**Exposure Assessment**

The ecological risk assessment documents describe the following exposure pathways and receptors that were used for quantitative assessments of the risks to ecological receptors:

- Aquatic biota are exposed to contaminants above risk-based criteria in surface water. Contaminants are transported to surface water via runoff from mine waste source materials and possible groundwater discharge from the shallow aquifer within the mine wastes.

- Aquatic biota are exposed to contaminants in mine wastes that are mobilized during rainfall events and deposited as sediments in nearby surface waters.

- Terrestrial plants are exposed to contaminants in mine waste areas via metals uptake through their roots and deposition of dust.

- Terrestrial vertebrates are exposed to contaminants in concentrations above threshold criteria through their diet of earthworms, fish or plants.

**Ecological Risk Characterization**

The ERAs concluded that there is ample evidence that both the aquatic and the terrestrial environments throughout the Site including OU5 CM&STS are contaminated by mine wastes and that living organisms in both environments are being exposed to COCs. The metals cause adverse effects on at least some receptors in each environment. The highest risk of adverse effects appears to be associated with terrestrial vertebrates that consume earthworms (avian and mammalian vermivores) in soils with elevated COCs concentrations. For more information, the EPA refers the public to the ERA which can be found in the AR.

**Uncertainties**

Many of the uncertainties discussed in the ERA and the BHHRA apply to the PRGs including but not limited to human and ecological exposure parameters, chemical absorption and risk estimates. There is also uncertainty with the use of the Integrated Exposure Uptake Biokinetic (IEUBK) model for evaluating short-term exposure. The IEUBK model is designed to project blood lead concentrations from sustained daily exposure over the first 84 months of childhood. Based on this assumption, it does not allow for a wash-out period between short-term exposures such as the child recreational visitor scenario where the child is exposed to sediments, surface water and floodplain soil for a four-month duration from May through September, rather than for an entire calendar year. Although pseudo-steady-state blood lead concentrations can be met during short-term exposures of greater than 90 days in duration, the IEUBK may overestimate blood lead predictions for the child recreational visitor.

## REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) set the goals of the remedial action and identify the RAOs for the mine wastes/source materials and transition surface soils, surface soils on-site, drainage ways, surface water and sediments, and shallow groundwater at OU5. The following RAOs were developed in accordance with A Guide to Preparing Superfund Proposed Plans, Records of Decisions, and Other Remedy Selection Decision Documents, OSWER 9200.1-23.P, July 1999:

- Reduce exposure to humans through routes of ingestion and dermal contact with soil, floodplain soil, mine waste and sediment impacted by COCs.
- Restrict access to groundwater, groundwater consumption and minimize future groundwater contamination to prevent unacceptable exposures.
- Minimize or eliminate COCs migration to surface water to levels that ensure the beneficial reuse of these resources.
- Reduce exposure of the ecological system to COCs in sediment and soil.

### Basis and Rationale for RAOs

Because there are no federal or state cleanup standards for soil contamination, the EPA established the stated cleanup levels based on information in the BHHRA and ERA. Cleanup levels were selected (based on preliminary remediation goals, or PRGs) that would both reduce the risk associated with human and ecological exposure to soil contaminants, primarily lead, to an acceptable level and ensure minimal migration of contaminants into the groundwater.

### Cleanup Levels for Mine Waste – Consolidation and Capping

Arsenic – 180 mg/kg
Cobalt – 130 mg/kg
Lead – 1460 mg/kg
Manganese – 2200 mg/kg
Nickel – 380 mg/kg

A determination will be made through 10 percent comparative analyses during the design phase to confirm historic evidence that achieving the cleanup standard for lead in soil will accomplish meeting the cleanup levels for the other COCs including arsenic, cobalt, manganese and nickel.

### Cleanup Levels for Soil - Excavation

Lead in Residential Soil – 400 mg/kg
Lead in Recreational Soil – 1,250 mg/kg

Other COCs besides lead present in soil most often coexist with lead; the cleanup levels are expected to be met when the lead concentrations are reduced. Comparative analyses will be incorporated in the remedial design using 10 percent of the samples collected for laboratory analysis to confirm the respective cleanup levels are met.

**Cleanup Levels for Floodplain Soil - Excavation**

Lead – 400 mg/kg

**Cleanup Levels for Sediment - Removal**

Lead – 150 mg/kg

Copper and manganese present in the floodplain soil and sediment are predicted to coexist with lead and are projected to be reduced to within their stated cleanup-level concentrations when the lead cleanup level is met. A comparative analysis will be incorporated in the remedial design using 10 percent of the samples analyzed by a laboratory to confirm the respective cleanup levels are met.

**Cleanup Levels for Surface Water**

Cleanup levels for surface water are not established since the overall exposure is negligible compared to the presence of COCs in sediment and floodplain soils. Surface runoff will be controlled through the engineering design of the cap to prevent future deposition of contamination to ditches, tributaries and streams. The removal of floodplain soils will further enhance surface water quality and will be monitored to confirm MNR is achieved.

**Cleanup Levels for Groundwater**

Cleanup levels for shallow groundwater are not established as numeric values since shallow, perched groundwater contamination is only documented to exist in the waste piles. The RAO for groundwater relates to decreasing the volume of precipitation water infiltrating the waste piles. The reduction of precipitation water percolating into the waste piles will further minimize hydraulic mounding preventing groundwater discharges or seeps to the surface at the sides and base of the capped areas. Consumption of groundwater will be prevented through environmental covenants with property owners under MoECA by preventing drilling of wells and potable use of groundwater. Shallow groundwater will be monitored to ensure migration outside the waste piles is not occurring.

## DESCRIPTION OF ALTERNATIVES

**Remedy Components**

Four remedial alternatives were developed for each OU5 subsite following the screening and evaluation of remedial technologies to meet the identified RAOs. These alternatives were developed to address all media identified in need of remedial action at OU5. Treatment of mine waste was not evaluated and included as remedial alternative due both to the volume of material present and the lack of a known, reliable treatment for the waste. Based on prior experience of the EPA Region 7 at similar sites, the unreliability of the treatment of high volume mine waste, the excessive costs in relation to balances and trade-offs, and the difficulty of precisely identifying corrective actions should a treatment remedy fail are reasons supporting its exclusion.

Both the Catherine Mines and the Skaggs Tailings subsites were evaluated under similar yet separate alternatives as a result of their physical characteristics. The Catherine Mines subsite has one mine waste deposit that is used as a residential soils repository which has been partially capped with soil and rock;

downstream impacts are limited based on earlier assessments. The Skaggs Tailings subsite has three mine waste deposits and more extensive transition soil that will be combined into one impoundment for capping, and also possesses a greater extent of downstream impacts to sediment and floodplain soils.

**Catherine Mines Subsite**

**Alternative 1 – No Action**. Under this alternative, the subsite would remain in its present condition, with no actions being taken to control or mitigate contamination or to prevent exposure to contaminants in the environment. This alternative is required to be evaluated by the NCP.

**Alternative 2 – Institutional Controls**. Under Alternative 2, RAOs would be addressed solely through the application of a variety of institutional controls that include a combination of land use changes, environmental covenants, fencing and signs. Groundwater, surface water and sediments in the vicinity of the subsite would require indefinite monitoring into the future as well as five-year reviews under Superfund.

**Alternative 3 – Sediment Excavation, On-Site Disposal, Low-Permeable Cover and Monitored Natural Recovery.** Under Alternative 3, the Catherine Mines chat area would be graded, contoured and covered with a low permeable cap. The cap would consist of a 1-foot clay layer and a 6-inch vegetative soil layer. The vegetation selected would be compatible with the local climate and require low maintenance. Mine waste and chat would not be excavated and moved as part of this alternative; however, prior to capping, contaminated sediment in the Catherine Pond would be excavated and transported to the chat area for placement under the cap. Following removal of contaminated material from the Catherine Mines Pond, bank restoration/stabilization measures would be implemented and damaged areas would be backfilled with topsoil and vegetated or seeded with native species. Access to the capped area would be controlled by fences and signs. Environmental covenants will be sought from owners and placed on the property to prevent uses that could disturb the cap. A cap monitoring program would be designed and implemented to ensure establishment of vegetation and the continued integrity of the facility. Periodic maintenance would be required and groundwater use restrictions would be employed to prevent future consumptive use. Groundwater monitoring would be performed for at least five years to ensure shallow groundwater was not migrating from the waste impoundments. MNR would be implemented at Logtown Branch to achieve the cleanup levels through natural sedimentation, which will cover contaminated sediment, preventing exposure and downstream migration. The surface water and sediment in Logtown Branch and Catherine Mines subsite pond would be sampled annually for a minimum of five years to determine whether the MNR is successful.

**Alternative 4 – Sediment Excavation, On-Site Disposal, Engineered Cap, and Monitored Natural Recovery.** Under Alternative 4, the Catherine Mines chat area would be graded, contoured, and covered with an engineered low permeable cap. The cap would consist of a low permeability (less than $1 \times 10^{-7}$ cm/sec) two-foot thick layer of natural clay or amended soil liner or geosynthetic clay liner as a substitute; a geomembrane of 60 milliliter of high density polyethylene, low density polyethylene or 30 mil polyvinyl chloride; a drainage layer; a protective soil cover; a vegetative soil layer; and a vegetated cover. The vegetation selected would be compatible with the local climate and require low maintenance. Mine waste and chat would not be excavated and moved as part of this alternative. Prior to cap placement, contaminated sediment in the Catherine Pond would be excavated and transported to the chat area for placement under the cap. Following removal of contaminated sediment from the Catherine Pond, bank restoration/stabilization measures would be implemented; damaged areas would then be backfilled with topsoil and vegetated or seeded with native species. Access to the capped area would be

controlled by fences and signs, and environmental covenants would be placed on the property to prevent uses that could disturb the cap under the MoECA. A cap-monitoring program would be designed and implemented to ensure establishment of vegetation and the continued integrity of the facility. Periodic maintenance would be required and groundwater use restrictions under the MoECA would be employed to prevent future consumptive use. Groundwater monitoring would be performed for at least five years to ensure shallow groundwater was not migrating from the waste impoundments. MNR would be implemented at Logtown Branch to achieve the cleanup levels through natural sedimentation, which will cover contaminated sediment, preventing exposure and downstream migration. The surface water and sediment in Logtown Branch and Catherine Pond would be sampled annually for a minimum of five years to determine whether MNR is successful.

**Skaggs Tailings Subsite**

**Alternative 1 – No Action**. Under this alternative, the subsite would remain in its present condition, with no actions being taken to control or mitigate contamination or to prevent exposure to contaminants in the environment. This alternative is required to be evaluated by the NCP.

**Alternative 2 – Institutional Controls**. Under Alternative 2, RAOs would be addressed solely through the application of a variety of institutional controls that include a combination of land use changes, environmental covenants, fencing and signs. Groundwater, surface water and sediments in the vicinity of the subsite would require indefinite monitoring into the future as well as five-year reviews under Superfund.

**Alternative 3 – Permeable Cover, Excavation and Disposal, and Monitored Natural Recovery.** This alternative would create a permeable soil and vegetation cover over the central chat area at the subsite to prevent wind and water erosion. Contaminated material in the central chat area would not be excavated, but would be covered in place with a permeable soil and vegetation cover. Chat and contaminated soil in the eastern and western chat areas would be excavated and included under the permeable cover placed on the central chat area. Floodplain soil at downstream locations would also be excavated and disposed of at the central chat area. Clean soil would be used to backfill the excavated areas. Sediment in the unnamed pond southwest of the chat area would be excavated and the sediment would also be placed at the central chat area prior to placement of the permeable cover. The covered area would be seeded with native species for added stability. Fencing and signage would be used to prohibit or restrict access to the permeable cover to prevent damage by off-road vehicles. In addition, environmental covenants would be used to prevent future excavation of the cover and groundwater use restrictions would be employed to prevent future consumptive use. Groundwater monitoring would be performed for at least five years to ensure shallow groundwater was not migrating from the waste impoundments. MNR would be implemented at the two unnamed tributaries at the subsite to achieve the lead cleanup level through natural sedimentation which will cover contaminated sediment, preventing exposure and downstream migration. The surface water and sediment would be sampled annually for a minimum of five years to determine whether the MNR is successful.

**Alternative 4 – Excavation, On-Site Disposal, Low-Permeable Cap and Monitored Natural Recovery.** This alternative would create a low-permeable cap consisting of a 1-foot clay layer and 6-inch soil and vegetative cover over the central chat area at the subsite to reduce precipitation infiltration and to prevent wind and water erosion. Contaminated material in the central chat area would not be excavated but covered in place with the low-permeable cap. A portion of the central chat area would be consolidated prior to construction of the cap. Chat and contaminated soil in the eastern and western chat

areas would be excavated and included under the low-permeable cap placed on the central chat area. Floodplain soil, in addition to sediments from the unnamed pond, would also be excavated and disposed of at the central chat area. Clean soil would be used to backfill the excavated areas. Sediment in the unnamed pond southwest of the chat area would be excavated and the sediment would also be placed at the central chat area prior to placement of the cap. The covered area would be seeded with native species for added stability. Fencing and signage would be used to prohibit or restrict access to the capped area to prevent damage by off-road vehicles. Land use and environmental covenants would be used to prevent future excavation into the cap and groundwater use restrictions would be employed to prevent future consumptive use. Groundwater monitoring would be performed for at least five years to ensure shallow groundwater was not migrating from the waste impoundments. MNR would be implemented at the two unnamed tributaries at the subsite to achieve the lead cleanup level through natural sedimentation which will cover contaminated sediment, preventing exposure and downstream migration. Surface water and sediment would be sampled annually for a minimum of five years to determine whether the MNR is successful.

**Common Elements and Distinguishing Features of Each Alternative**

Alternatives 3 and 4 for each subsite include the common elements of consolidating the wastes on-site, capping the waste and performing various types of monitoring activities to assess performance of the clean up. The main difference between the two alternatives is the type of cap used to cover the wastes.

**Expected Outcomes of Each Alternative**

Consolidation and capping of the wastes in Alternatives 3 and 4 for each subsite would allow for development of the property around the capped areas. At least five years of monitoring would be necessary for both alternatives to ensure the effectiveness of the remedy before allowing unlimited use of surface water resources.

## SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of alternatives using each of the nine evaluation criteria is presented in this section. The purpose of this analysis is to describe the common elements and distinguishing features unique to each response option as well as identify the advantages and disadvantages of each alternative relative to the other alternatives. A separate comparison of the alternatives is presented under the heading of each criterion.

According to the NCP, nine criteria are used to evaluate the different alternatives individually and against each other to select the best remedy. The nine evaluation criteria are (1) overall protection of human health and the environment; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility or volume of contaminants through treatment; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state/support agency acceptance; and (9) community acceptance. This section of the ROD profiles the relative performance of each alternative when measured against the nine criteria and each other. Seven of the nine evaluation criteria are discussed below. The state acceptance and community acceptance are presented in the ROD's Responsiveness Summary. A detailed analysis of these alternatives can be found in the FS Report.

The EPA will not address naturally occurring lead ores in their undisturbed state as part of this action. Although the Site has been heavily mined in the past, it may still be possible to encounter naturally

occurring lead ores during excavation. Section 104(a)(3)(A) of CERCLA states that removal or remedial actions shall not be provided in response to a release of threat of release of a naturally occurring substance in its unaltered form or altered solely through natural processes in a location where it is naturally found. Naturally occurring lead ores could be found at the bedrock interface and in undisturbed clay soils near the surface. Another indicator of the presence of naturally occurring lead ores could be a high density of galena crystals in soils or unusually high concentrations of lead in excavated soils. When these conditions are encountered, they will be documented, excavation will stop and backfill initiated.

**Catherine Mines Subsite**

**Overall Protection of Human Health and the Environment**

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls and/or institutional controls.

Alternatives 3 and 4 would be protective of human health and the environment. Both of these alternatives primarily rely on on-site containment of media exceeding action levels to attain RAOs. The major difference in these two alternatives is that compared to the cap in Alternative 3, the engineered cap in Alternative 4 is expected to substantially reduce infiltration through the contained waste. Both alternatives include excavation of the contaminated sediments which should reduce or eliminate exposures to human and ecological receptors from the sediments in the pond. Both alternatives also include MNR in Logtown Branch which, over time, is projected to be protective of ecological exposures to aquatic life. Alternative 2 would achieve a moderate degree of protectiveness for human health, but would not be protective of the environment. Institutional controls such as installation of signs, fencing and environmental covenants would not prevent exposures to ecological organisms. Alternative 1 would not be protective of human health or the environment.

**Compliance with ARARs**

Section 121(d) of CERCLA and NCP 300.430.(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Alternatives 3 and 4 are expected to comply with chemical-specific ARARs for soil, mine waste and sediment in the pond. Alternatives 3 and 4 are likely to meet chemical-specific ARARs for groundwater. Because the engineered cap is expected to provide a greater reduction in the infiltration of precipitation through the chat, Alternative 4 should be more likely to meet chemical-specific ARARs for groundwater. There is presently insufficient information to determine whether surface water and sediment quality of the Logtown Branch will meet action levels without additional remedial actions for either alternative. Both of these alternatives would meet all location- and action-specific ARARs. Alternative 1 and Alternative 2 would not comply with chemical- or location-specific ARARs. Because neither alternative includes active remedial technologies, action-specific ARARs would not be triggered.

**Long-term Effectiveness and Permanence**

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

The long-term effectiveness of Alternatives 3 and 4 would be very similar. The primary difference between the two alternatives is that the engineered low-permeable cap in Alternative 4 is expected to achieve a higher degree of groundwater protection. Both alternatives rely on proper design, construction and maintenance of the cap. Alternative 2 would be less effective and reliable because it relies on maintenance of signs and fences in addition to the public's willingness to heed warnings. This alternative is not effective in preventing exposures to the environment. Alternative 1 is not reliable or effective in preventing exposures to humans or the environment.

**Reduction of Toxicity, Mobility or Volume**

Reduction of toxicity, mobility or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives 3 and 4 would contain the contaminated mine wastes, soil and sediment. The containment will substantially reduce contaminant mobility for these media, especially from wind and surface water runoff. Compared to Alternative 3 that has a low-permeable cap, the Alternative 4 engineered low-permeability cap consisting of a synthetic membrane would further reduce contaminant mobility by reducing the amount of precipitation infiltrating through the mine wastes and leaching contaminants to the groundwater. Alternatives 1 and 2 would not achieve any reductions in toxicity, mobility or volume.

**Short-term Effectiveness**

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Because no remedial actions would be implemented, there are no short-term risks to the community, workers or the environment associated with Alternative 1. Similarly, minimal short-term risks would be associated with Alternative 2. Alternatives 3 and 4 would have similar short-term risks to the community, workers and environment. These risks include the physical hazards associated with heavy equipment operation and potential human and environmental exposures to contaminants during excavation activities. The use of best-management practices would significantly reduce potential adverse effects during implementation of these alternatives.

**Implementability**

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

No remedial actions would be implemented with Alternative 1. Similarly, minimal remedial actions needed to implement Alternative 2 are straightforward. Implementation of Alternative 2, 3 and 4 would require coordination with local agencies to prevent future use of groundwater for drinking water. Implementation of Alternatives 3 and 4 primarily rely on standard earthmoving and construction technologies. Supplies and materials are readily available locally or through specialized companies (example: geomembranes or geosynthetic clay liner required for engineered, low-permeability cap). Alternatives 3 and 4 would also require ongoing maintenance of the cap containing mine wastes and coordination with local agencies to prevent disturbance of the containment areas.

**Cost**

The estimated present worth costs for the four alternatives evaluated ranges from $53,900 to $16,284,620. A detailed cost summary for Alternative 3 is listed in Table 3-1. A summary of the costs for each alternative evaluated is as follows:

- Alternative 4 has the highest present worth cost at $16,284,620. The capital cost of this alternative is $15,883,350 and the total O&M costs are $844,350.
- Alternative 3 has the next highest present worth cost of $2,653,540, with total O&M costs of $802,630.
- Alternative 2 has a present worth cost of $721,700, with total O&M costs of $437,380.
- Alternative 1 has a present worth cost of $53,900 that is associated with the EPA's five-year reviews at the site.

**State Acceptance**

MDNR has provided formal concurrence of the Preferred Alternative in the Proposed Plan at the division level. The Responsiveness Summary includes comments from MDNR both at the public meeting and in its concurrence letter.

**Community Acceptance**

The community, including local citizens and elected officials, support the Selected Remedy presented in the Proposed Plan as the Preferred Alternative. The Responsiveness Summary, which captures public questions and comments, has been included as part of the ROD.

**Skaggs Tailings Subsite**

**Overall Protection of Human Health and the Environment**

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced or controlled through treatment, engineering controls and/or institutional controls.

Alternative 4 would provide more protection of human health and the environment than Alternative 3. Both alternatives control exposures to human and ecological receptors from contaminants in the eastern and western chat areas at the subsite. Both of these alternatives primarily rely on on-site containment of media exceeding action levels to attain RAOs at the central chat area. The major difference in these two alternatives is that the low-permeable cap included in Alternative 4 is expected to substantially reduce infiltration through the contained mine waste. Both Alternatives 3 and 4 include excavation of contaminated sediments in the on-site pond which is expected to reduce or eliminate exposures to human and ecological receptors from these sediments. Both alternatives also include MNR in the unnamed tributaries, which, over time, should be equally protective of ecological exposures to aquatic life. Alternative 2 would achieve a moderate degree of protectiveness for human health, but would not be protective of the environment. Institutional controls such as installation of signs, fencing and environmental covenants would not prevent exposures by ecological organisms. Alternative 1 would not be protective of human health or the environment.

**Compliance with ARARs**

Section 121(d) of CERCLA and NCP 300.430.(f)(1)(ii)(B) require that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Alternatives 3 and 4 would be almost equally compliant with chemical-specific ARARs for soil, mine wastes and sediments from the unnamed pond. Because the low-permeability cap is expected to achieve a higher reduction in the amount of precipitation infiltrating through the mine waste than a permeable cap, Alternative 4 would be more likely to achieve groundwater ARARs. There is presently insufficient information to determine whether surface water and sediment quality of unnamed tributaries will meet action levels without additional remedial actions for either alternative. Both Alternatives 3 and 4 would meet all location- and action-specific ARARs. Alternative 1 and Alternative 2 would not comply with chemical- or location-specific ARARs. Because neither alternative includes active remedial technologies, action-specific ARARs would not be triggered.

**Long-term Effectiveness and Permanence**

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk that will remain on-site following remediation and the adequacy and reliability of controls.

The long-term effectiveness of Alternatives 3 and 4 would be very similar. The main difference between Alternatives 3 and 4 is that the low-permeable cap in Alternative 4 would be expected to achieve a higher degree of groundwater protection than Alternative 3 by reducing precipitation infiltrating through the mine waste. Alternative 2 would be less effective and reliable because it relies on maintenance of signs and fences in addition to the public's willingness to heed warnings. This alternative is not effective in preventing exposures to the environment. Alternative 1 is not reliable or effective in preventing exposures to humans or the environment.

**Reduction of Toxicity, Mobility or Volume**

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Alternatives 3 and 4 would both contain approximately 62,000 cubic yards of contaminated mine wastes, soil and sediment. The containment will substantially reduce the contaminant mobility for these media, especially from wind and surface water runoff. Alternative 4 would further reduce the mobility of contaminants by reducing the amount of precipitation infiltrating through the consolidated mine wastes and leaching contaminants to the groundwater. The reduction in surface water and sediment contaminant concentrations in the unnamed tributaries are expected to be similar for Alternatives 3 and 4. Alternatives 1 and 2 would not achieve any reductions in toxicity, mobility or volume.

**Short-term Effectiveness**

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved.

Because no remedial actions would be implemented, there are no short-term risks to the community, workers or the environment associated with Alternative 1. Similarly, only minimal short-term risks would be associated with Alternative 2. Alternatives 3 and 4 would have similar short-term risks to the community, workers and environment. These risks include the physical hazards associated with heavy equipment operation and potential human and environmental exposures to contaminants during excavation activities. The use of best management practices would significantly reduce potential adverse effects during implementation of these alternatives.

**Implementability**

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

No remedial actions would be implemented with Alternative 1. Similarly, the minimal remedial actions needed to implement Alternative 2 are straightforward. Implementation of Alternatives 2, 3, and 4 would require coordination with local agencies to prevent future use of groundwater for drinking water. Implementation of Alternatives 3 and 4 primarily rely on standard earth-moving and construction technologies. Supplies and materials are readily available locally. Alternative 4 would require a source of natural clay for the low-permeable cap. Alternatives 3 and 4 would also require ongoing maintenance of the cap/cover and coordination with local agencies to prevent disturbance of the containment area.

**Cost**

The estimated present worth costs for the four alternatives evaluated ranges from $53,900 to $3,268,620. A detailed cost summary for Alternative 4 is listed in Table 3-2. A summary of the costs for each alternative evaluated is as follows:

- Alternative 4 has the highest present worth cost at $3,268,620. The capital cost of this alternative is $2,984,950 and the total O&M costs are $562,150.

- Alternative 3 has the next highest present worth cost of $2,737,300 with total O&M costs of $724,050.

- Alternative 2 has a present worth cost of $1,066,700 with total O&M costs of $522,650.

- Alternative 1 has a present worth cost of $53,900 that is associated with the EPA five-year reviews at the site.

**State Acceptance**

MDNR has provided formal concurrence of the Preferred Alternative. The Responsiveness Summary includes responses to comments from MDNR both at the public meeting and in the concurrence letter.

**Community Acceptance**

The community, including local citizens and officials, support the Selected Remedy presented in the Proposed Plan as the Preferred Alternative. The Responsiveness Summary, which captures public questions and comments, has been included as part of the ROD.

## PRINCIPAL THREAT WASTES

According to the Office of Solid Waste and Emergency Response, OSWER Directive 9380.3-06FS, A Guide to Principal Threat and Low Level Threat Wastes, dated November 1991:

> Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur.

Based on the above definition, the mine waste at OU5 CM&STS does not constitute a "principal threat waste." Although concentrations for various heavy metals in some samples exceed toxicity standards, data indicating that limited groundwater contamination has occurred supports the heavy metals possess limited mobility in the environment to which they have been released and can be controlled. Migration of contamination at OU5 CM&STS has occurred through transport via natural, erosion processes. The remedy uses constructed, engineered components as permanent solutions and alternative treatment technologies for seepage water to the maximum extent practicable, but does not use treatment as a principal element for mine waste because of the lack of demonstrated, effective treatment alternatives.

## SELECTED REMEDY

### Summary of the Rationale for the Selected Remedy

The rationale for the Selected Remedy for OU5 CM&STS is to eliminate exposure of the site receptors to the COCs contained in mine waste, soil, sediment, surface water and groundwater by removing mine waste, removing soil in the transitions zones surrounding the mine waste piles and in floodplains and removing sediment in ponds; consolidating the wastes at the respective subsite repositories and;

constructing a low-permeable cap to be placed over the transported soils. In addition, environmental covenants would be put in place with the respective property owners to prevent damage to the caps which could result in exposure to the waste and prevent consumption of groundwater. Another purpose of the environmental covenants is to provide notice to future owners of the presence of hazardous substances and allow restrictions and conditions placed in the environmental covenants to run with the land.

The decisive factors that led to the choice of the Selected Remedy were: (1) Overall protection of human health and environment; (2) compliance with ARARs; (3) reduction in toxicity, mobility and volume of waste; (4) cost; and (5) state acceptance.

For the Catherine Mines subsite, Alternative 3 was chosen over Alternative 4. Although Alternative 4 may provide slightly more overall protection of human health and environment by preventing all infiltration of surface water into the waste pile, the excessive cost ($2,653,540 for Alternative 3; $16,284,620 for Alternative 4) is significant. Considering all other criteria comparisons are nearly identical, Alternative 3 is the best balance of tradeoffs. Either Alternative 3 or 4 would be superior to Alternatives 1 and 2. Given the key criteria to be considered in documenting the decision stated in the NCP at 40 CFR § 300.430(f)(4), Alternative 3 with a low-permeable cover and lower costs was superior to Alternative 4 with an engineered cap and significantly higher costs.

For the Skaggs Tailings subsite, Alternative 4 was chosen over Alternative 3. The major difference is that the overall protection of human health and the environment is increased with the construction of a low-permeable cap under Alternative 4 compared to the permeable cap under Alternative 3. Either Alternative 3 or 4 would be superior to Alternatives 1 and 2. The cost difference between Alternative 3 ($2,737,300) and Alternative 4 ($3,268,620) is not significantly higher and was considered worthwhile given the added protectiveness. Given the key criteria to be considered in documenting the decision stated in the NCP at 40 CFR § 300.430(f)(4), Alternative 4 with a low-permeable cap provides the best balance of tradeoffs with only a marginal cost difference.

The design and placement of the caps at OU5 CM&STS benefits downstream locations by preventing COCs loading from erosion and runoff. The caps will reduce surface water infiltration that could result in seeps discharging to the surface. Reduced infiltration and percolation further serves as a stabilization component preventing saturation and slumping of the caps and will ensure the integrity of the low-permeable caps minimizing the need for future construction repairs. Monitoring groundwater around the waste impoundment perimeter will be conducted to ensure shallow groundwater is not migrating from the capped locations.

MNR of the creek and tributaries at OU5 CM&STS will include sediment and stream monitoring to evaluate if protectiveness can be established without removal of the sediment remaining in streams and floodplains during a five-year period after consolidation and construction of the caps is completed. If MNR is not successful in preventing downstream exposure or migration of contaminated sediment during the five-year monitoring period, the impacted stream system will be included in the OU7 – Watershed response actions to be addressed in the future.

Properties affected by the former overhead tramway will be assessed and remediated under the OU3 IROD addressing residential property cleanups which includes public-use and child high-use areas. Environmental covenants under MoECA with the property owner will serve to control access to prevent activities such as construction, drilling of wells and use of the property for recreational purposes that

could damage the construction, engineering and natural components of the remedy resulting in receptor exposure to contamination that has been protected with barriers. Environmental covenants will also provide notice to future owners of the presence of hazardous substances and allow restrictions and conditions placed in the environmental covenants to run with the land.

The protective measures in the Selected Remedy are standard practice for high-volume mine waste sites and are much more cost effective than removal, transport and disposal at a hazardous waste disposal facility.

**Description of the Selected Remedy**

The Selected Remedy for the OU5 CM&STS is as follows:

**Catherine Mines Subsite**: Alternative 3 – Sediment Excavation, On-Site Disposal, Low-Permeable Cover and Monitored Natural Recovery.

Under Alternative 3, sediment in the Catherine Mines Pond will be excavated and transported to mine waste location. The mine waste area will be graded, contoured and covered with a low permeable cover, or cap, will consist of a one-foot clay layer and a 6-inch vegetative soil layer. The vegetation selected will be compatible with the local climate and require low maintenance. Mine waste and chat will remain in its current location to be covered.

Following removal of contaminated material from the 3.5-acre pond, bank stabilization and restoration measures will be implemented and affected areas will be backfilled with topsoil and vegetated or seeded with native species. Access to the capped area will be controlled by fences and signs, and environmental controls pursuant to MoECA. The use of these engineering controls and ICs are to prevent activities and uses that could disturb the cap. A cap-monitoring program will be designed and implemented to ensure establishment of vegetation and the continued integrity of the facility where periodic maintenance will be required. Groundwater use restrictions will be employed through the environmental covenants with property owners to prevent consumptive use.

Groundwater monitoring will be performed to determine if the shallow, contaminated groundwater in the waste impoundment is migrating away from the site. One upgradient monitoring well and three downgradient monitoring wells will be installed around the perimeter of the cap. All of the monitoring wells will be sampled semiannually for the first two years, and annually thereafter for three years. In the event the EPA determines shallow, contaminated groundwater is migrating from the site, groundwater monitoring will be continued. It is assumed that the groundwater monitoring wells will be approximately 20 feet deep and groundwater samples will be analyzed for metals.

MNR will be implemented at Logtown Branch to determine if the lead concentration in the sediment will achieve the action level without active remediation. The sediment and surface water in Logtown Branch will be sampled annually for a minimum of five years to determine whether MNR is successful. In the event the EPA determines that MNR cannot be successful, stream sediment will be addressed as part of the response actions for OU7 to be addressed in the future.

**Skaggs Tailings Subsite:** Alternative 4 – Excavation, On-Site Disposal, Low-Permeable Cap and Monitored Natural Recovery. Under this alternative, mine waste and contaminated soil in the eastern and western chat areas will be excavated and transported to the central chat area. The central chat pile will be graded to approximately half of its existing size by increasing the elevation. The western chat area is approximately three acres in size and is estimated at 5,000 cubic yards. The eastern chat area is approximately one-third acre in size and is estimated at 580 cubic yards. Floodplain soil from the tributaries downstream of the chat areas estimated at 488 cubic yards and sediment from the quarter-acre pond will also be excavated and consolidated with the mine waste. After consolidation, the central chat area will be graded, contoured and covered with a low-permeable cap. Clean soil will be used to backfill the excavated areas. The current size of the central chat area is approximately 9 acres and is estimated to be approximately 4 feet in depth containing approximately 56,000 cubic yards of mine waste. After consolidation, the total acreage of the capped repository will cover approximately 5 acres.

Trees, shrubs and vegetation will be cleared and grubbed and the chat pile will be graded to the appropriate slope and shape for closure. Fugitive mine waste scattered outside the current chat locations in other locations of mine/mill works on-site will be evaluated to determine removal needs during the RA/RD phase. These areas will also be excavated and consolidated at the central chat area prior to construction of the cap. The chat will be graded to the designed elevation contours necessary to divert storm water from the capped area to natural and/or constructed drainages.

The consolidated waste will be compacted for stability. The cap construction will consist of a 1-foot compacted clay layer. A 6-inch soil layer with sufficient organics to support vegetation will be placed over the clay layer. The top of the cover will be vegetated to provide long-term erosion control. The vegetation selected will be compatible with the local climate and require low maintenance. Construction of the low-permeable cap will require six to eight months.

Access to the capped area may be prevented by fences and signs. An environmental covenant will be agreed upon with the property owner to prevent uses that could disturb the cap. Groundwater use restrictions will also be placed in the environmental covenant to prevent consumptive use under MoECA. A cap-monitoring program will be designed and implemented to ensure establishment of vegetation and the continued integrity of the facility. Periodic maintenance will be required to repair the cap and maintain the established vegetation on the cap.

MNR will be implemented at the two unnamed tributaries at the Skaggs Tailings subsite to determine if the lead concentration in the sediment will achieve the action level without active remediation. Additional assessment to fully characterize the lateral extent of contamination of sediment in the tributaries will be performed during the initial design phase. There is insufficient information at the present time to determine whether the sediment in the streams will achieve action levels without additional remedial actions such as dredging or the installation of barriers in the streams to encourage the deposition of clean sediment. However, until the mine wastes from the source area are controlled, use of these technologies to remediate the streams is not appropriate because the streams will continue to be contaminated by mine wastes from the source area. Implementation of MNR monitoring at the start of the RD/RA phase will enable the natural recovery process to be evaluated before and after the source area is controlled. Stream sediment may be removed to enhance the success of MNR.

Monitoring stations will be identified in the tributaries, and samples will be collected from the monitoring stations to determine if mine waste is continuing to impact surface water and sediment. The surface water and sediment would be sampled annually for at least five years following control of the

source areas to determine whether MNR is successful. Surface water samples would be analyzed for total and dissolved metals, and sediment samples would be analyzed for metals. The success of MNR will be determined after consolidation and capping. If MNR is not achieved, stream sediment will be addressed under the OU7 – Watershed response actions in the future.

Groundwater monitoring will be performed to determine if the shallow groundwater is migrating away from the waste impoundments. One upgradient monitoring well and three downgradient monitoring wells will be installed. All of the monitoring wells will be sampled semiannually for the first two years, and annually thereafter for three years. If the EPA determines shallow groundwater is migrating from the waste impoundments, groundwater monitoring will be continued and any surrounding groundwater use will be evaluated through sampling. It is assumed that the groundwater monitoring wells will be approximately 20 feet deep and groundwater samples will be analyzed for metals.

**Summary of Estimated Remedy Costs**

Tables detailing the cost estimates for the Selected Remedy are presented below. The present worth cost for the selected remedial alternatives is estimated to be $5,922,160 for OU5 CM&STS. The capital costs are spread over a construction period of one year. A seven percent discount rate was used to calculate the present worth. A present worth analysis was performed to evaluate project costs over five years and is included in the table. This estimate is approximate and made without detailed engineering data. Tables 3-1 and 3-2 provide detailed estimated costs associated with the selected remedial alternatives which are based on the best available information regarding the anticipated scope of the Selected Remedy. Some changes in the cost elements are likely to occur as a result of new information and data collected during the RD/RA phase. The estimate is an order-of-magnitude engineering cost with an expected accuracy within +50 to -30 percent of the actual project cost. Major changes, if they arise, will be documented in the form of a memorandum in the AR, an amendment to the ROD or an Explanation of Significant Differences (ESD).

**Expected Outcomes of the Selected Remedy**

The Selected Remedy will provide a response that is protective of human health to on-site humans, nearby residents and site visitors, and the on- and off-site ecological systems associated with the OU5 subsites. The removal and consolidation of tailings, contaminated soils and sediment and capping in a repository will provide a permanently protective barrier preventing exposure to the COCs as long as O&M is routinely performed and the requirements of the environmental covenants with property owners are implemented. The cleanup levels for surface water and sediment will meet the Region 7 PRGs established from risk calculations which are determined protective to human health and the ecological systems associated with OU5 CM&STS.

Future commercial and agriculture use of the remediated properties will continue. The consolidation of mine waste at the repositories should open a larger portion of the properties to unrestricted use. Commercial use of the properties could be expanded, and residential development could likely be accommodated outside the capped repositories. Surrounding property uses will remain unchanged. Achieving the PRGs for surface water and sediment could result in unlimited recreational use for the stream systems and ponds.

The possible increase in commercial business and residential development would result in a positive socioeconomic impact by creating jobs in the local area.

The remedial action for the Selected Remedy will take an estimated one and one-half years to implement with a construction time estimated at one year. The estimated time frame to achieve the RAOs is five years after construction is complete.

## STATUTORY DETERMINATIONS

The EPA expects the Selected Remedy to satisfy the following statutory requirement of section 121(b) of CERCLA: (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost-effective, (4) use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable, and (5) satisfy the preference for treatment as a principal element or explain why the preference for treatment will not be met. The following sections discuss how the Selected Remedy meets these statutory requirements.

### Protection of Human Health and the Environment

Potential exposure to humans through ingestion and inhalation of COCs in soil and groundwater at the site will be eliminated through consolidation of mine waste, transition mine waste and soils at the perimeter, sediment from the ponds, and floodplain soil from affected tributaries. Contaminated materials will be placed beneath the low permeable caps, one each at the Catherine Mines subsite and Skaggs Tailings subsite.

The low-permeable caps at CM&STS are projected to reduce infiltration of surface water to the consolidated waste by approximately 40 percent. The reduction in infiltration will reduce the collection of water in the shallow subsurface of the repositories beneath the caps serving to both reduce impacts to water coming in contact with mine waste, and reducing the potential for groundwater collection and leaching of contaminants that could result in discharges or seeps from the repositories. Proper grading, construction of effective drainage systems and the vegetated cover will prevent exposures by eliminating the migration of contamination by wind and water erosion in addition to preventing erosion that could expose the contained waste to receptors.

Capping and vegetation will minimize potential exposures to terrestrial organisms and alleviate the phytotoxicity currently observed in the tailings area. Establishment of healthy vegetation would increase habitat for terrestrial organisms, help maintain the integrity of the cover and further reduce erosion by wind and storm water runoff.

Excavation of contaminated floodplain soil is expected to eliminate the phytotoxicity along the affected tributaries and enhance stream water quality. Excavation of contaminated sediment in the ponds will remove the source of contamination currently causing adverse impacts to aquatic biota that may also be consumed by humans. Streams will be restored by preventing additional waste from entering the water courses which should enhance biological recovery. If it is determined MNR will not result in protectiveness from exposures to sediment and prevent downstream migration, excavation of sediment may be pursued under OU7 – Watershed response actions. Following monitoring and/or removal actions, levels of lead in fish tissue and toxicity to benthic invertebrates are expected to decrease. It is anticipated that removal actions in on-site drainages will result in an increase in density and diversity of organisms in these areas.

The environmental covenants with the property owners will eliminate risks associated with ingestion of shallow groundwater by potential future residents or commercial workers by prohibiting the use of groundwater for drinking water. These agreements will also prohibit human disturbance of protected areas to prevent damage that could affect the protectiveness established by the caps.

**Compliance with Applicable or Relevant and Appropriate Requirements**

The selected remedial alternatives for CM&STS are expected to meet all state and federal location- and action-specific ARARs shown in Tables 2-4 through 2-6. Specifically, excavation within the floodplain and streambed of the unnamed tributary would be expected to result in significant improvement of conditions within the floodplain, wetlands and streambed. Compliance with Executive Order 11988 (Protection of Floodplains), Executive Order 11990 (Protection of Wetlands), Clean Water Act, Fish and Wildlife Conservation Act of 1980 and the Fish and Wildlife Coordination Act, along with controls such limiting recreational and disturbance activities to prevent adversely impacting ecological receptors within and downstream of these sensitive environments, would be required.

All excavation activities would require compliance with the Clean Air Act, the Missouri Fugitive Particulate Matter Regulations, Missouri Clean Water Law, and the Missouri Hazardous Substances Emergency Response Law and the use of appropriate controls to monitor and mitigate emissions of airborne particulates and prevent storm water releases.

Drilling and construction of the monitor wells will require compliance with the Missouri Water Well Driller's Act, specifically 10 CSR 23-4.

Construction and maintenance of an on-site containment area and cap will require compliance with Subtitle D of RCRA, Executive Order 11988, Executive Order 11990, Clean Water Act and Clean Air Act.

Discharge of surface water to dewater the ponds prior to sediment excavation will require compliance with the Clean Water Act, Missouri Clean Water Law and an NPDES Discharge Permit or equivalency.

**Cost Effectiveness**

In the EPA's judgment, the Selected Remedy—Alternative 3 for the Catherine Mines subsite and Alternative 4 for the Skaggs Tailings subsite—is cost effective and represents a reasonable value for the money to be spent. In making this determination, the following definition was used: "A remedy shall be cost effective if its costs are proportional to its overall effectiveness." (NCP 300.430[f][1][ii][D]). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost effectiveness. The relationship of the overall effectiveness of the remedial alternatives was determined to be proportional to its costs and hence the alternatives represent a reasonable value for the money to be spent.

The estimated present worth cost of the combined selected alternatives comprising the Selected Remedy is $5,922,160. All other alternatives, with exception of Alternative 4 for the Catherine Mines subsite, were less expensive but would not have resulted in an acceptable level of protectiveness. Although slightly more protective, Alternative 4 was not chosen over Alternative 3 because its cost of over $15

million would more than triple the overall cost of the Selected Remedy, yet would be expected achieve only a slightly higher, if any, level of protectiveness and therefore would not represent the best balance of trade-offs.

**Utilization of Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable**

The EPA has determined that the Selected Remedy among the alternatives evaluated is the one with the best balance of trade-offs with respect to the balancing criteria in the NCP. When the Selected Remedy is in place, it will provide for a permanent solution to eliminating exposure risks to human and ecological receptors given that the constructed components, engineering components and environmental covenants are maintained and repaired as needed. The Selected Remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a practicable manner at this site. The EPA has determined that the Selected Remedy provides the best balance of trade-offs with respect to the balancing criteria while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering State and community acceptance.

The Selected Remedy uses a well-demonstrated remediation approach considered reliable and cost effective considering the volume of waste present. The constructed components will provide physical barriers to eliminate COC exposure and off-loading to the associated water courses. The environmental covenants with the property owners will serve as institutional controls that will result in the additional protection that the constructed components cannot provide and will provide long-term effectiveness in conjunction with the O&M that will be provided by MDNR. Short-term risks during construction can reasonably be controlled through best management practices such as watering for dust control, controlling precipitation runoff, and through construction site safety training of employees working under well-developed health and safety plans and required attendance at safety meetings.

**Preference for Treatment as a Principal Element**

The Selected Remedy uses MNR to address the risks posed to receptors by contaminated sediment and surface water in the tributaries and creek. No treatment technologies have been identified for mine tailings, surface soil and sediment that have definitively or reliably demonstrated the ability to provide short- and long-term effectiveness, permanence and meet the other NCP criteria for large-volume waste sites. Treatment is not employed for shallow groundwater since contamination of groundwater in the mine waste piles will remain on-site but protected from access and consumption through the environmental covenants with the property owners.

**Five-Year Review Requirements**

Because this remedy will result in hazardous substances, pollutants or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, a statutory review will be conducted within five years after initiation of the remedial action to ensure that the remedy is or will be protective of human health and the environment in accordance with section 121(c) of CERCLA and the NCP at 40 CFR § 300.430(f)(5)(iii)(C). Initiation of remedial action will be determined by the "actual RA on-site construction" date that will trigger the review.

## DOCUMENTATION OF SIGNIFICANT CHANGES

The EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary or appropriate.

## GLOSSARY OF TERMS

This glossary defines many of the technical terms used in relation to the Madison County Mines site in this ROD. The terms and abbreviations contained in this glossary are often defined in the context of hazardous waste management and apply specifically to work performed under the Superfund program. Therefore, these terms may have other meanings when used in a different context.

**Administrative Record (AR):** All documents which the EPA considers or relies upon in selecting the response action at a Superfund site, culminating in the Record of Decision for remedial action.

**Baseline Human Health Risk Assessment (BHHRA):** A document that provides an evaluation of the potential threat to human health in the absence of any remedial action.

**Bioavailability:** A risk assessment term; the fraction of an ingested dose that crosses the gastrointestinal epithelium in the stomach and becomes available for distribution to internal target tissues and organs.

**Blood lead level or concentration**: The concentration of lead in the blood, measured in micrograms of lead per deciliter of blood (µg/dl).

**Capital Cost**: Direct (construction) and indirect (nonconstruction and overhead) costs including expenditures for equipment, labor and materials necessary to implement remedial actions.

**Comprehensive Environmental Response, Compensation and Liability Act (CERCLA):** A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. The acts created a special tax that went into the Trust Fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the program, the EPA can either: (1) pay for site cleanup when parties responsible for the contamination cannot be located or are unwilling or unable to perform the work, or (2) take legal action to force parties responsible for site contamination to clean up the site or pay back the federal government the cost of the cleanup.

**Contaminant:** Any physical, chemical, biological or radiological substance or matter that can have an adverse effect on human health or environmental receptors.

**Contaminant of Concern (COC):** A substance detected at a hazardous waste site that has the potential to affect receptors adversely due to its concentration, distribution and mode of toxicity.

**Discount rate:** A percentage rate used in present worth analyses to identify the cost of capital and operation and maintenance expenses. It is used to value a project using the concepts of the time-value of money where future cash flows are estimated and discounted to give them a present value.

**Dolomite:** A sedimentary rock containing greater than 50 percent of the mineral dolomite; often found with calcite in forming limestone, another sedimentary rock.

**Exposure pathways:** The course a chemical or physical agent takes from a source to an exposed organism. Each exposure pathway includes a source or release from a source, an exposure point and an exposure route.

**Feasibility Study (FS):** A report that analyzes the practicability of potential remedial actions; that is, a description and analysis of potential cleanup alternatives for a site on the National Priorities List.

**Groundwater:** Water filling spaces between soil, sand, rock and gravel particles beneath the earth's surface, which often serves as a source of drinking water.

**Interim:** Temporary or provisional efforts (as used in the Proposed Plan) that address a portion of the Madison County Mines site on a temporary basis until the final remedy for the entire operable unit is implemented.

**Limestone:** A common sedimentary rock consisting mostly of calcium carbonate and aragonite.

**Maximum Contaminant Levels (MCLs):** Concentrations established by the EPA in conjunction with the Safe Drinking Water Act to define the maximum concentration for contaminants in public drinking water supplies

**National Contingency Plan (NCP):** The federal regulation that guides the Superfund program.

**National Priorities List:** The EPA's list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial action under Superfund. The list is based primarily on the score a site receives from the Hazard Ranking System.

**Operation and Maintenance (O&M):** Activities conducted at a site after response actions occur to ensure that the cleanup or containment system continues to be effective.

**Preliminary Remediation Goals**: Site-specific concentration values set as cleanup targets based on known and projected human health and ecological risks.

**Present worth**: The amount of money necessary to secure the promise of future payment or series of payments at an assumed interest rate.

**Proposed Plan:** A plan for a site cleanup that is available to the public for comment which summarizes remedy alternatives and presents the EPA's Preferred Alternative or cleanup approach.

**Record of Decision (ROD):** A public document that explains which cleanup alternative(s) will be used at a National Priorities List site.

**Remedial action:** The actual construction or implementation phase of a Superfund site cleanup.

**Remedial Investigation (RI):** An in-depth study designed to gather data needed to determine the nature and extent of contamination at a Superfund site, establish site cleanup criteria, identify preliminary alternatives for remedial action and support technical and cost analyses of alternatives. The RI is usually done with the feasibility study. Together they are usually referred to as the RI/FS.

**Removal action**: Short-term immediate actions taken to address releases of hazardous substances that require an expedited response.

**Responsiveness Summary:** A summary of oral and/or written public comments received by the EPA during a comment period on key EPA documents and the EPA's response to those comments.

**Toxicity:** The degree to which a chemical substance (or physical agent) elicits a deleterious or adverse effect upon the biological system of an organism exposed to the substance over a designated time period.

## RESPONSIVENESS SUMMARY FOR THE RECORD OF DECISION

## CATHERINE MINES and SKAGGS TAILINGS SUBSITES
## OPERABLE UNIT 05
## Madison County Mines Superfund Site
## Madison County, Missouri

This Responsiveness Summary has been prepared in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Contingency Plan (NCP), 40 CFR § 300.430(f). This document provides the U.S. Environmental Protection Agency's response to all significant comments received from the public on the Proposed Plan for the OU5 portion of the Madison County Mines Superfund site (Site) during the 30-day comment period.

The Responsiveness Summary consists of the following three components: an overview of the public process, responses to verbal questions received at the public meeting and responses to written correspondence received during the public comment period. This document is provided to accompany the Record of Decision (ROD) and reflects input resulting from the public comment process.

### Overview

The Proposed Plan and supporting documents included in the Administrative Record (AR) were made available for public review and comment for 30 days from July 19 to August 19, 2012. No potentially responsible parties are being pursued for these actions. A public meeting was held at the Site at the Black River Electric Cooperative in Fredericktown, Missouri, on July 24, 2012, with five local citizens in attendance. A summary of the questions and comments from local and state officials and the public is included in the AR.

One letter was received during the 30-day public comment period. Submitted by MDNR, the letter supports the Preferred Alternative in the Proposed Plan. This letter has been added to the AR and is paraphrased in the summary below.

### Responses to Verbal Questions

This summary provides generalized designations or affiliations for individuals asking questions. The transcript of the meeting taken by the EPA's Community Involvement Coordinator for the Site with questions from the public meeting has been added to the AR, along with brief summary of responses made to those questions.

Question from citizen (local contractor) – The citizen inquired about contracting the construction work associated with the OU5 Remedy. He indicated he has recently started a company involving the type of work proposed and is wondering, in general, how the contracting process works so he can bid on the project.

EPA response to the citizen – The citizen was informed our site-specific contracts target small business contractors and are competitive bids open to the public. The solicitations will be published on the Office of Acquisition Management (OAM) and the EPA's website.

Letter from MDNR dated August 6, 2012 – The letter provides general concurrence with the Preferred Alternative outlined in the Proposed Plan. MDNR did, however, provide specific comments paraphrased below. The EPA's response to those comments follows.

MDNR Comments – MDNR is concerned the Remedial Investigation did not adequately assess the full extent of contamination of sediment and other downstream contamination in Logtown Branch Creek and the unnamed tributaries at the Skaggs Tailings subsite necessary to select a remedial action incorporating Monitored Natural Recovery (MNR) as part of the remedy. MDNR also expressed that the site data inadequately characterized the waste materials around mine/mill areas in addition to soils surrounding the waste piles referred to as transition soils.

MDNR is concerned, due to limited stream flow and upstream drainage to these streams contributing clean sediment from and around the OU5 CM&STS locations, that MNR may not suitably address the contamination and recommends the EPA further evaluate the site conditions to determine the applicability of MNR in the remedy. MDNR expressed their preference for sediment to be excavated, consolidated and capped in the impoundment locations. They suggest the collection of additional data during the Remedial Design (RD) to further justify the selection of MNR in the remedy and to evaluate if sediment and transition soil excavation, consolidation and capping be included in the Selected Remedy.

Response – The EPA incorporates the collection of additional data during the RD phase to both characterize media quality and further define the horizontal extent of sediment in downstream locations. This data will be necessary to not only establish baseline information, but also to implement MNR. Sampling stations will be identified in the channel for continued sampling subsequent to remedial action construction completion for OU5. Soil in both the transition zone and floodplain soil along the tributary streams will be characterized and scheduled for excavation during remedial action construction. Stream sediment will also be removed as necessary to enhance MNR. In the event MNR cannot be achieved, the EPA will include the stream(s) in OU7 – Watershed response actions in the future.

Mine/mill working areas will also be included in the RD sampling to determine the need for removal at those locations. Contamination determined to exceed the R7 PRGs at OU5 CM&STS will be removed, consolidated and capped in the impoundments at each subsite.

**Response to Written Correspondence**

No written correspondence relating to the Proposed Plan or the selected remedial alternatives was received during the public comment period.

STATE OF MISSOURI
Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director
DEPARTMENT OF NATURAL RESOURCES
www.dnr.mo.gov

AUG - 6 2012

Ms. Cecilia Tapia, Director
Superfund Division
U.S. EPA, Region VII
901 North 5th Street
Kansas City, KS 66101

Dear Ms. Tapia:

The Missouri Department of Natural Resources has reviewed the "Proposed Plan, Operable Unit 5, Madison County Mines Superfund Site, Madison County, Missouri" dated July 2012, as prepared by the U.S. Environmental Protection Agency (EPA), Region VII. The Department generally concurs with the EPA's preferred remedial action alternatives for the Catherine and Skaggs Subsites as outlined in the Proposed Plan for Operable Unit 5 (OU5). However, we have concerns regarding the portions of the proposed remedy for Logtown Branch (Catherine Subsite) and the tributary streams leading from the Skaggs Subsite, and contaminated soils surrounding the Catherine and Skaggs Subsites (transition soils). We recommend that the EPA conduct additional data collection during Remedial Design to further justify selection of the preferred remedial action alternative in the Proposed Plan, and for purposes of possibly modifying portions of the proposed Remedial Action.

It is our understanding that the proposed remedy for the Catherine Subsite is Alternative 3 in the Proposed Plan, which includes excavation, on-site disposal, a low permeability cap, and monitored natural recovery (MNR) for downstream sediment. Prior to capping, contaminated sediment from the Catherine Pond would be excavated and placed under the cap. Bank restoration/stabilization measures would be implemented and damaged areas would be backfilled with topsoil and vegetated or seeded with native species. Access to the capped area would be controlled by fences and signs, and an environmental covenant would be placed on the property to prevent uses that could disturb the cap, and to prevent consumption of groundwater. A cap monitoring program would be designed and implemented to ensure establishment of vegetation and the continued integrity of the cap. Groundwater monitoring would be performed by the EPA for at least five years to determine if the shallow groundwater was migrating from the site. MNR would be implemented at Logtown Branch to determine if the lead concentration in the sediment will achieve the action level without active remediation. The surface water and sediment in Logtown Branch and Catherine Pond would be sampled annually by the EPA for a minimum of five years to determine whether the MNR is successful.

It is our understanding that the proposed remedy for the Skaggs Subsite is Alternative 4 in the Proposed Plan, which includes excavation, on-site disposal, a low permeable cap and MNR for

downstream sediment. Chat and contaminated soil in the eastern and western chat areas would be excavated and moved to the central chat area and would be graded, contoured, and covered with a low permeability cap. Sediment in the unnamed 0.25 acre pond southwest of the chat area would be excavated and the sediment placed on the central chat area prior to placement of the cap. Access to the capped area would be prevented by fences and signs, and there would be an environmental covenant put in place to prevent uses that could disturb the cap, and to prevent consumption of groundwater. A cap monitoring program would be designed and implemented to ensure establishment of vegetation and the continued integrity of the cap. MNR would be implemented at the two unnamed tributaries at the Skaggs Subsite to determine if the lead concentration in the sediment will achieve the action level without active remediation. Surface water and sediment samples would be collected by the EPA from two locations in each of the unnamed tributaries to determine if the mine wastes were continuing to impact the surface water and sediment. The surface water and sediment would be sampled annually by the EPA for at least five years following control of the source areas to determine whether the MNR is successful. Groundwater monitoring would be performed by EPA to determine if the shallow groundwater at the site was migrating away from the site.

We are concerned that the Remedial Investigation did not provide sufficient data to adequately characterize contaminant levels and the horizontal and vertical extent of sediment and other downstream contamination for Logtown Branch and the unnamed drainages that flow from the Skaggs Subsite for purposes of evaluating remedial action alternatives and selecting a proposed remedial action. Without adequate characterization, it is difficult to assess whether the proposed remedy of MNR would be appropriate. The Department requests that the EPA conduct additional sampling as part of the Remedial Design to assure that any downstream sediment and other depositional areas along the streams/drainages are addressed by the Remedial Action. Our preference would be for excavation and inclusion of any identified pockets of tailings material and soil contamination exceeding risk-based levels under the proposed capped areas, which would be consistent with the approach used at other such sites in Missouri.

We question the current justification for proposed use of MNR at this site for downstream sediment remediation. As commented above, we believe the extent of downstream sediment and other contamination has not yet been fully determined. This information is needed to determine whether there is contaminated sediment and other downstream deposits that may warrant excavation and consolidation with other materials capped on site. As it is, the Feasibility Study did not evaluate remedial action alternatives involving excavation and consolidation and capping of these materials to compare with other alternatives including MNR. In addition, given the general lack of continuous water flow from the identified streams/drainages, and the general lack of sources of clean material from the areas drained by these streams/drainages, the likelihood of MNR succeeding in reducing contaminant levels appears to be minimal. It appears likely that contaminated sediment from the drainage ways and other downstream deposits may require excavation, consolidation, and on-site capping, perhaps in combination with MNR, depending on the results of complete characterization of downstream sediment and other deposits.

The Remedial Investigation contains very limited data regarding potential contamination of transition soils around the mine/mill waste areas, and the Proposed Plan is unclear regarding how transition soil contamination will be addressed in the Remedial Action. We request that the EPA conduct additional sampling during Remedial Design to fully characterize transition soil contamination to determine the extent of this soil contamination that will require excavation, consolidation and capping on-site.

We understand that the EPA has identified no currently viable potentially responsible parties for this Operable Unit. Based on the cost estimates in the Feasibility Study, it is anticipated that the state of Missouri will be expected to take over operation and maintenance on this site no earlier than year six of the remedy, after completion of the First Five-Year Review. It is anticipated that a Superfund State Contract will be required to be in place before the EPA fund-lead Remedial Action can begin.

Thank you for the opportunity to participate in selection of the remedial action for OU5. If additional or unanticipated issues come to light during the public comment period and completion of the Record of Decision, the Department reserves the right to provide additional input that may affect the outcome of the Record of Decision. If you have any comments or questions, please Mr. Evan Kifer with the Department's Hazardous Waste Program, Superfund Section, P.O. Box 176, Jefferson City, MO 65102-0176, by telephone at (573) 751-1990, or by e-mail to evan.kifer@dnr.mo.gov.

Sincerely,

DIVISION OF ENVIRONMENTAL QUALITY

for Alan J. Reinkemeyer
Acting Division Director

AJR:ckj

FIGURE 1 – LOCATION MAP

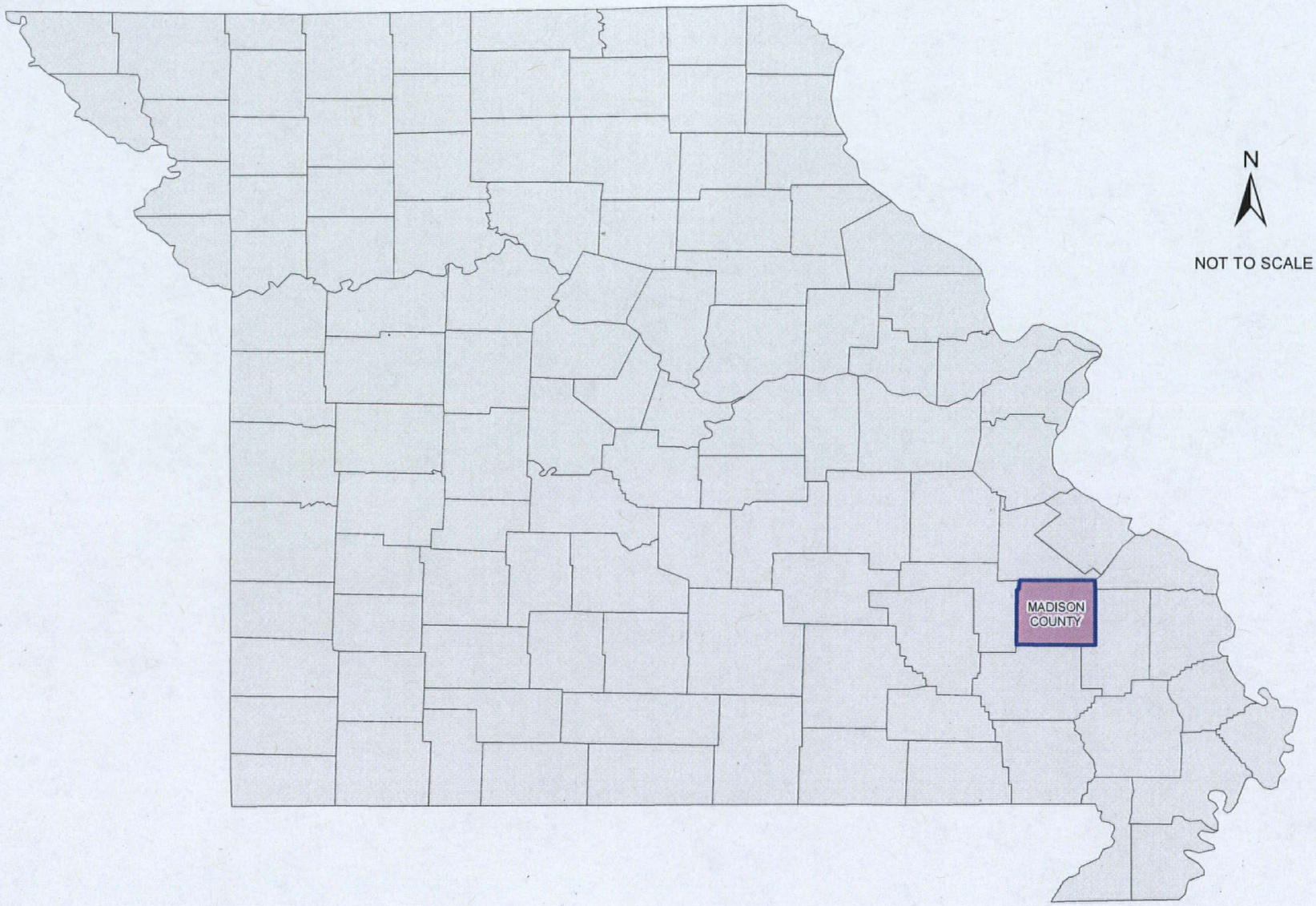


FIGURE 1:
LOCATION MAP

MADISON COUNTY MINES
FREDERICKTOWN, MISSOURI

FIGURE 2 – SITE MAP

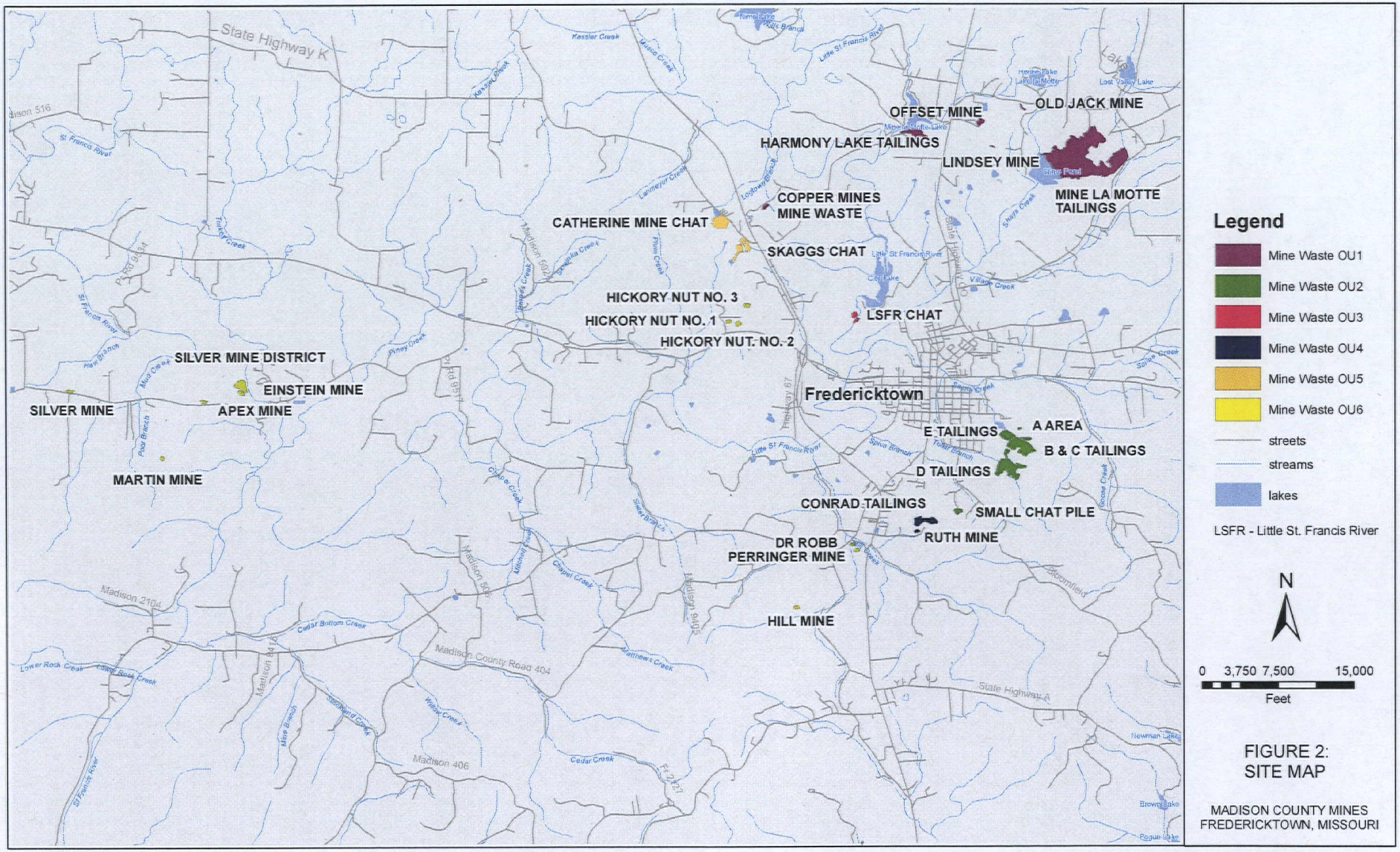


FIGURE 2:
SITE MAP

MADISON COUNTY MINES
FREDERICKTOWN, MISSOURI

FIGURE 3 – FEATURES OF CATHERINE AND SKAGGS SUBSITES

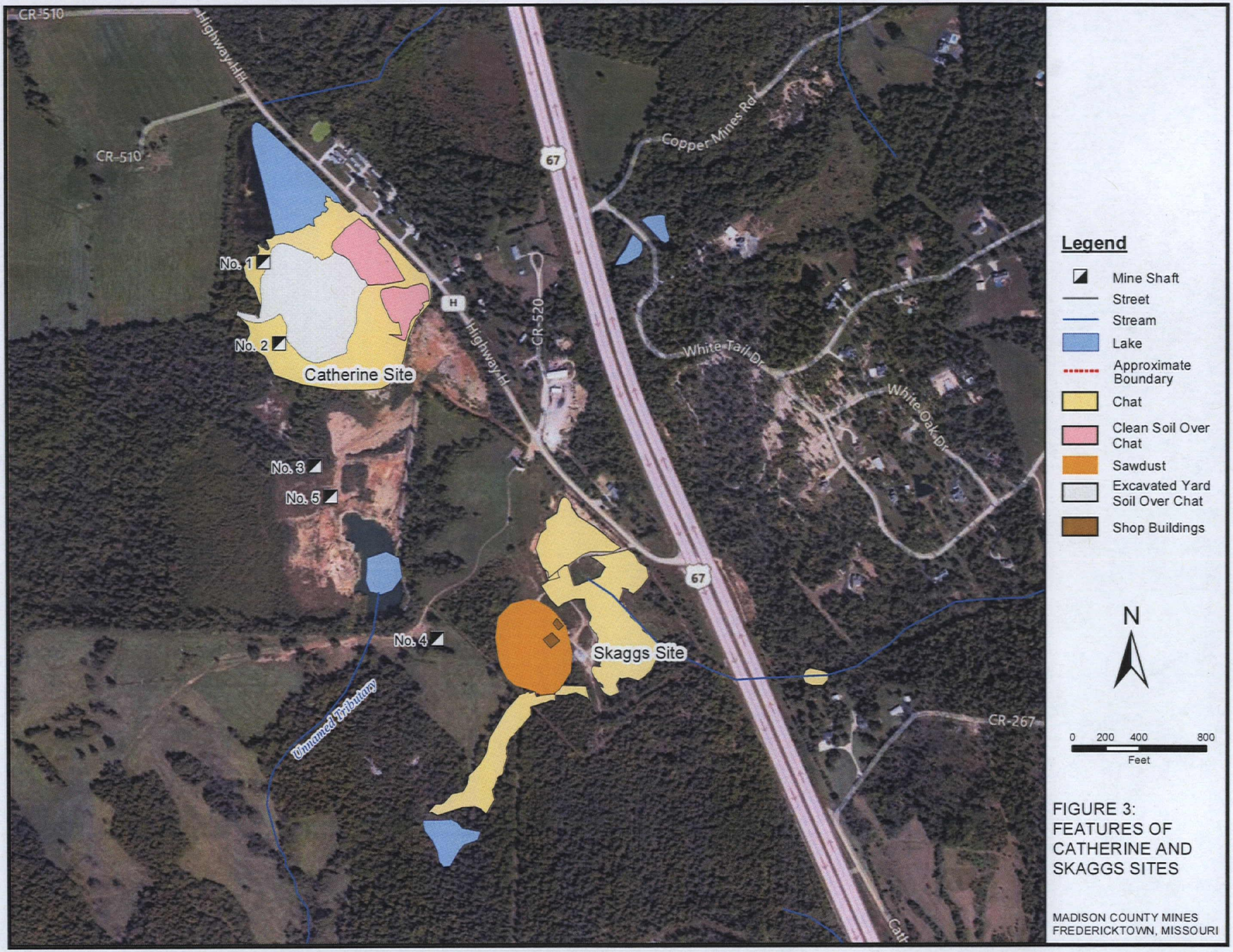


FIGURE 3:
FEATURES OF
CATHERINE AND
SKAGGS SITES

MADISON COUNTY MINES
FREDERICKTOWN, MISSOURI

FIGURE 4 – CONCEPTUAL SITE MODEL FOR EXPOSURE

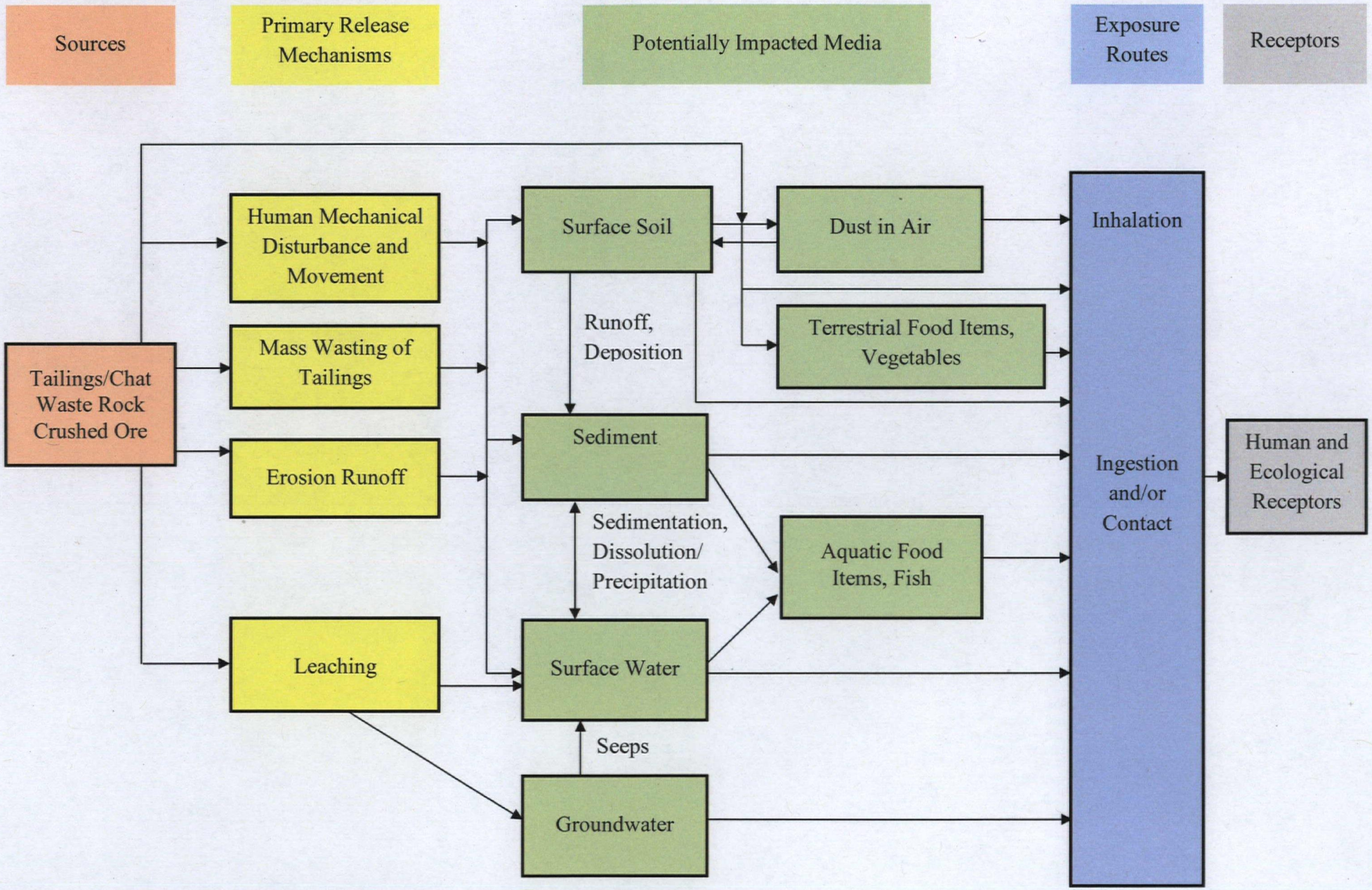


Figure 4
Conceptual Site Model
Madison County Mines Site
Fredericktown, MO

# TABLES

**Table 1-1. PRGs' Receptors and Exposure Pathways for Human Health Risk Assessments**

| Environmental Media | Receptor | Exposure Pathways |
|---|---|---|
| Mine Waste Tailings | ATV Rider | Incidental Ingestion of Tailings<br>Dermal Contact with Tailings<br>Inhalation of Tailings-derived Dust |
| Soil | Residential<br>Commercial Worker<br>Recreational Visitor | Incidental Ingestion of Soil<br>Dermal Contact with Soil |
| Groundwater | Residential<br>Commercial Worker | Hypothetical Incidential Ingestion of Shallow Groundwater |
| Surface Water | Recreational Visitor | Incidental Ingestion of Surface Water<br>Dermal Contact with Surface Water |
| Sediment | Recreational Visitor | Incidental Ingestion of Sediment<br>Dermal Contact with Sediment |
| Fish | Recreational Visitor | Ingestion of Fish |

**Table 1-2. PRGs' Receptors and Exposure Pathways for Ecological Risk Assessments**

| Environmental Media | Receptor | Assessment Endpoints |
|---|---|---|
| Mine Waste Tailings | Plants, Soil Invertebrates, Herbivores, Vermivores, Carnivores | AE 1, 2, 3, and 4 |
| Soil | Plants, Soil Invertebrates, Herbivores, Vermivores, Carnivores | AE 1, 2, 3, and 4 |
| Surface Water | Aquatic Life | AE 5 |
| Sediment | Benthos | AE 6 |

AE 1 = Protection of Nutrient Cycling
AE 2 = Protection of Terrestrial Herbivores
AE 3 = Protection of Terrestrial Vermivores
AE 4 = Protection of Terrestrial Carnivores
AE 5 = Protection of Aquatic Life (Surface Water)
AE 6 = Protection of Benthos (Sediment)

# Table 2-1
# Federal Chemical-Specific ARARs

| | Citations | Description |
|---|---|---|
| A. ARARs | | |
| 1. Safe Drinking Water Act | National Primary Drinking Water Standards<br>40 C.F.R. Part 141 Subpart B and G | Establishes maximum contaminant levels (MCLs), which are health based standards for public waters systems |
| 2. Safe Drinking Water Act | National Secondary Drinking Water Standards<br>40 C.F.R. Part 143 | Establishes secondary maximum contaminant levels (SMCLs) which are non-enforceable guidelines for public water systems to protect the aesthetic quality of the water. SMCLs may be relevant and appropriate if groundwater is used as a source of drinking water. |
| 3. Safe Drinking Water Act | Maximum Contaminant Level Goals (MCLGs)<br>40 C.F.R. Part 141, Subpart F | Establishes non-enforceable drinking water quality goals. The goals are set to levels that produce no known anticipated adverse health effects. The MCLGs include an adequate margin of safety. |
| 4. Clean Water Act | Water Quality Criteria<br>40 C.F.R. Part 131 Water Quality Standards | Establishes non-enforceable standards to protect aquatic life. May be relevant and appropriate to surface water discharges, or may be a TBC. |
| 5. Clean Air Act | National Primary and Secondary Ambient Air Quality Standards<br>40 C.F.R. Part 50 | Establishes standards for ambient air quality to protect public health and welfare. |
| B. To Be Considered | | |
| 1. EPA Revised Interim Soil-lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities | Office of Solid Waste and Emergency Response (OSWER) Directive 9355.4-12, July 14, 1994<br>OSWER Directive 9200.4-27P, August 1988 | Establishes screening levels for lead in soil for residential land use, describes development of site-specific preliminary remediation goals, and describes a plan for soil-lead cleanup at CERCLA sites. This guidance recommends using the EPA Integrated Exposure Uptake Biokinetic Model (IEUBK) on a site-specific basis to assist in developing cleanup goals. |
| 2. EPA Strategy for Reducing Lead Exposures | EPA, February 21, 1991 | Presents a strategy to reduce lead exposure, particularly to young children. The strategy was developed to reduce lead exposure to the greatest extent possible. Goals of the strategy are to 1) significantly reduce the incidence above 10 µg Pb/dL in children; and 2) reduce the amount of lead introduced into the environment. |
| 3 Human Health Risk Assessment Reports (HHRA) | "Area-Wide Human Health Risk Assessment for the Madison County Mines Site, Madison County, Missouri" – prepared by Syracuse Research Corp., July 2007<br>"Draft Supplemental Remedial Investigation Report, Madison County Mines Site, prepared by Black & Veatch Special Projects Corp, April 2011 | Evaluates baseline health risk due to current site exposures and established contaminant levels in environmental media at the site for the protection of public health. The risk assessment approach using this data should be used in determining cleanup levels because ARARs are not available for contaminants in mine wastes and soils. |
| 4 Ecological Risk Assessment Report (ERA) | "Madison County Mine Site Ecological Risk Assessment, Final Report" – prepared by EPA, May 24, 2006.<br>"Draft Supplemental Remedial Investigation Report, Madison County Mines Site, prepared by Black & Veatch Special Projects Corp, April 2011 | Evaluates baseline risks to ecological receptors due to current site exposures and established contaminant levels in environmental media at the Madison County Mines Site. |
| 5 Superfund Lead-Contaminated Residential Sites Handbook | EPA OSWER 9285.7-30, August 2003 | Handbook developed by EPA to promote a nationally consistent decision making process for assessing and managing risks associated with lead contaminated residential sites across the country. |

## Table 2-1
## (Continued)
## Federal Chemical-Specific ARARs

| | | |
|---|---|---|
| 6 Preliminary Remediation Goals | Preliminary Remediation Goals for Lead in Soil at the Madison County Mines, Operable Unit 3 Site, Madison County Missouri, January 31, 2008. | Establishes preliminary remediation goals for protection of residents from lead in surface soil at the Madison County Mines, Operable Unit 3. |
| 7. Preliminary Remediation Goals | Final draft preliminary remediation goals for lead in multiple media at the Madison County Mines, Operable Unit 4 Site, Madison County Missouri, December 11, 2008. | Establishes preliminary remediation goals for protection of ATV riders, recreational visitors, and residents from lead in tailings, floodplain soils, sediments, surface water, and groundwater at the Madison County Mines, Operable Unit 4 subsite. |

## Table 2-2
## State Chemical-Specific ARARs

| | Citation | Description |
|---|---|---|
| A. ARARs | | |
| 1. Missouri Air Conservation Law | Missouri Department of Natural Resources<br>RSMo 643.010<br>10 CSR 10-6.010 | Sets ambient air quality standards for a variety of constituents, including particulate matter and lead. Provides long range goals for ambient air quality throughout Missouri in order to protect the public health and welfare. |
| 2. Hazardous Waste Management Law | Missouri Department of Natural Resources<br>Identification and Listing of Hazardous Waste<br>10 CSR 25-4.261 | Defines those solid wastes which are subject to regulations as hazardous wastes under 10 CSR 25. |
| 3. Missouri Clean Water Law | Missouri Department of Natural Resources<br>RSMo 644.006<br>10 CSR 20-7.015 (1) (2) (3) (4) (5) (6) (7) (9) | Sets forth the limits for various pollutants which are discharged to the various waters of the state. Sets effluent standards that will protect receiving streams. |
| 4. Missouri Clean Water Law | Missouri Department of Natural Resources<br>RSMo 644.006<br>10 CSR 20-7.031 (2) (3) (4) (5); Tables (A) (B) | Identifies beneficial uses of waters of the State, criteria to protect their uses, and defines the antidegradation policy. |
| B. To Be Considered | None | |

# Table 2-3
# Federal Location-Specific ARARs

| | Citation | Description |
|---|---|---|
| A. ARARs | | |
| 1. Historic project owned or controlled by a federal agency | National Historic Preservation Act 16 U.S.C. 470, et.seq; 40 C.F.R. § 6.301; 36 C.F.R. Part 1. | Property within areas of the Site is included in or eligible for the National Register of Historic Places. The remedial alternatives will be designed to minimize the effect on historic landmarks |
| 2. Site within an area where action may cause irreparable harm, loss, or destruction of artifacts. | Archeological and Historic Preservation Act; 16 U.S.C. 469, 40 C.F.R. 6.301. | Property within areas of the site may contain historical and archaeological data. The remedial alternative will be designed to minimize the effect on historical and archeological data. |
| 3 Site located in area of critical habitat upon which endangered or threatened species depend. | Endangered Species Act of 1973, 16 U.S.C. 1531-1543; 50 C.F.R. Parts 17; 40 C.F.R. 6.302. Federal Migratory Bird Act; 16 U.S.C. 703-712. | Determination of the presence of endangered or threatened species. The remedial alternatives will be designed to conserve endangered or threatened species and their habitat, including consultation with the Department of Interior and U.S. Fish and Wildlife Service if such areas are affected. |
| 4. Site located within a floodplain soil. | Protection of Floodplains, Executive Order 11988; 40 C.F.R. Part 6.302, Appendix A. | Remedial action may take place within a 100-year floodplain. The remedial action will be designed to avoid adversely impacting the floodplain in and around the soil repositories to ensure that the action planning and budget reflects consideration of the flood hazards and floodplain management. |
| 5. Wetlands located in and around tailings, chat piles, or soil repositories. | Protection of Wetlands; Executive Order 11990; 40 C.F.R. Part 6, Appendix A. | Remedial actions may affect wetlands. The remedial action will be designed to avoid adversely impacting wetlands wherever possible including minimizing wetlands destruction and preserving wetland values. |
| 6. Waters in and around the tailings, chat piles and soil repositories. | Clean Water Act, (Section 404 Permits) Dredge or Fill Substantive Requirements, 33 U.S.C. Parts 1251-1376; 40 C.F.R. Parts 230,231. | Capping, dike stabilization, construction of berms and levees, and disposal of contaminated soil, waste material or dredged material are examples of activities that may involve a discharge of dredge or fill material.<br>Four conditions must be satisfied before dredge and fill is an allowable alternative:<br>1 There must not be a practical alternative.<br>2. Discharge of dredged or fill material must not cause a violation of State water quality standards, violate applicable toxic effluent standards, jeopardize threatened or endangered species or injure a marine sanctuary.<br>3. No discharge shall be permitted that will cause or contribute to significant degradation of the water.<br>4. Appropriate steps to minimize adverse effects must be taken.<br>Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem. |

## Table 2-3
## (Continued)
## Federal Location-Specific ARARs

| | Citation | Description |
|---|---|---|
| 7. Area containing fish and wildlife habitat in and around the removal repository. | Fish and Wildlife Conservation Act of 1980, 16 U.S.C. Part 2901 et seq.; 50 C.F.R. Part 83.9 and 16 U S C. Part 661, et seq. Federal Migratory Bird Act, 16 U.S.C Part 703. | Activity affecting wildlife and non-game fish. Remedial action will conserve and promote conservation of non-game fish and wildlife and their habitats. |
| 8. Fish and Wildlife Coordination Act | 16 U S.C Section 661 et seq.; 33 C.F.R Parts 320-330; 40 C.F.R 6.302 | Requires consultation when a Federal department or agency proposes or authorizes any modification of any stream or other water body, and adequate provision for protection of fish and wildlife resources. |
| 9. 100-year floodplain | Location Standard for Hazardous Waste Facilities- RCRA; 42 U.S.C 6901; 40 C.F.R. 264.18(b) | RCRA hazardous waste treatment and disposal. Facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout during any 100-year/24 hour flood. |
| 10. Historic Site, Buildings, and Antiquities Act | 16 USC Section 470 et seq. 40 CFR Sect. 6.301(a), and 36 CFR, Part1. | Requires Federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks and to avoid undesirable impacts on such landmarks. |
| 11. Clean Air Act | National Ambient Air Quality Standards/ NESHAPS 42 U.S.C. 74112; 40 C.F.R. 50.6 and 50 12 | Emissions standards for particular matter and lead. |
| B. To Be Considered | None | |

## Table 2-4
## Potential State Location-Specific ARARs

| | Citation | Description |
|---|---|---|
| A. Applicable Requirements | | |
| Missouri Well Construction Code | Missouri Department of Natural Resources RSMo 256.606, 256.626 10 CSR 23-3 | Addresses the construction of new residential wells. Well construction standards are specific to location. For some sites where shallow contamination exists, Special Areas have been developed as an institutional control to prevent exposure to contaminants. |
| B. To Be Considered | None | |

# Table 2-5
# Federal Action-Specific ARARs

| A. ARARs | Citation | Description |
|---|---|---|
| 1. Disposal of Solid Waste in a Permanent Repository. | Subtitle D of RCRA, Section 1008, Section 4001, et seq., 42 U.S.C. '6941, et seq. | State or Regional Solid Waste Plans and implementing federal and state regulations to control disposal of solid waste. The mine wastes and soils disposed in the repositories may not exhibit the toxicity characteristic and therefore, are not hazardous waste. However, these mine wastes and soils may be solid waste. Soils failing TCLP were contaminated by mining wastes so all wastes are exempt from definition of hazardous per the Bevill exemption. Contaminated residential soils and mine wastes will be consolidated onto the existing tailings and chat piles at the OU1, OU4, and OU5 sites. The disposal of this waste material should be in accordance with regulated solid waste management practices. |
| 2. Clean Water Act. | Water Quality Criteria<br>40 C.F.R Part 131 Water Quality Standards | Establishes non-enforceable standards to protect aquatic life. |
| 3. Clean Air Act | National Ambient Air Quality Standards/ NESHAPS 42 U.S.C. 74112; 40 C.F.R. 50.6 and 50.12 | Emissions standards for particular matter and lead. |
| 4. Hazardous Materials Transportation Act | Hazardous Materials Transportation Regulations<br>49 C.F.R. Parts 107, 171-177 | Regulates transportation of hazardous materials. |
| 5. NPDES Storm Water Discharge for Permanent Repositories. | 40 C.F.R. Part 122.26; 33 U S.C 402 (p) | Establishes discharge regulations for storm water. Required management of repository where waste materials come into contact with storm water. Also required during construction of the repository. |
| 6. Transportation of excavated mine wastes and soils. | DOT Hazardous Material Transportation Regulations, 49 C.F.R. Parts 107, 171-177 | Regulates transportation of hazardous wastes |
| 7. Waters in and around the soil repositories. | Clean Water Act, (Section 404 Permits) Dredge or Fill Substantive Requirements, 33 U.S.C Parts 1251-1376, 40 C.F.R. Parts 230,231. | Capping, dike stabilization, construction of berms and levees, and disposal of contaminated soil, waste material or dredged material are examples of activities that may involve a discharge of dredge or fill material.<br>Four conditions must be satisfied before dredge and fill is an allowable alternative:<br>1. There must not be a practical alternative.<br>2. Discharge of dredged or fill material must not cause a violation of State water quality standards, violate applicable toxic effluent standards, jeopardize threatened or endangered species or injure a marine sanctuary.<br>3. No discharge shall be permitted that will cause or contribute to significant degradation of the water.<br>4 Appropriate steps to minimize adverse effects must be taken.<br>Determine long- and short-term effects on physical, chemical, and biological components of the aquatic ecosystem. |
| 8. Subtitle C of RCRA 42 U.S.C. 6921, et seq. | 40 C.F. R. Parts 260 – 268<br>Hazardous Waste Management | Establishes requirements for the transportation and disposal of hazardous wastes, including those wastes that are hazardous because they exhibit the toxicity characteristic. May be relevant and appropriate for wastes exhibiting the toxicity characteristic that are transported and disposed off site. |
| 9. Toxic Substances and Control Act 15 U.S.C 2601, et Seq. | 40 C.F.R Part 761 61 PCB Remediation Waste | Establishes cleanup levels and disposal requirements for bulk PCB-contaminated remediation waste, including PCB-contaminated soils. |
| B. To Be Considered | | |

# Table 2-6
# State Action-Specific ARARs

| A. ARARs | Citation | Description |
|---|---|---|
| 1. Missouri Fugitive Particulate Matter Regulations | Missouri Department of Natural Resources<br>10 CSR 10-6.170 | The Missouri fugitive particulate matter regulations contain restrictions on the release of particulate matter to ambient air. These regulations are applicable to any dust emissions that occur as a result of remedial actions taken at the site. |
| 2. Missouri Clean Water Law – Storm Water Regulations | Missouri Department of Natural Resources<br>10 CSR 20-6.200 | These regulations define Best Management Practices for land disturbances, including practices or procedures that would reduce the amount of metals in soils and sediments available for transport to waters of the state. Permits would not be required for actions taken under CERCLA, but the substantive provisions of these regulations would be applicable. The Missouri standards would be considered ARARs only if they are more stringent than the Federal standards. Requires permits for metal and non-metal mining facilities and land uses or disturbances that create point source discharges of storm water. |
| 3. Missouri Hazardous Substances Emergency Response | Missouri Department of Natural Resources<br>RSMo 260.520<br>10 CSR 24-3.010 | Establishes a statewide emergency telephone number to notify the State whenever a hazardous substance emergency occurs and specifies the requirements for emergency notification and follow up written notice. |
| 4. Missouri Solid Waste Disposal Law | Missouri Department of Natural Resources<br>RSMo 260.225<br>10 CSR 80-5.010 (2) | Contains requirements for determining what solid wastes will be accepted at landfills and identifying any special handling requirements. |
| 5. Missouri Solid Waste Disposal Law | Missouri Department of Natural Resources<br>RSMo 260.225<br>10 CSR 80-5.010 (5) (A), (B) 1-4, (C) | Requires all waters discharged from solid waste processing facilities to be sufficiently treated to meet applicable water quality standards, including those established under the authority of the Federal Water Pollution Control Act. |
| 6. Missouri Hazardous Waste Management Law | Missouri Department of Natural Resources<br>RSMo 260.370<br>10 CSR 25-5.262 | Sets forth standards for generators of hazardous waste, incorporates 40 CFR Part 262 by reference, and sets forth additional state standards. |
| 7. Missouri Hazardous Waste Management Law | Missouri Department of Natural Resources<br>RSMo 260.385 and 260.395<br>10 CSR 25-6.263 | Sets forth standards for transporters of hazardous waste, incorporates 40 CRF Part 263 and certain regulations in 49 CFR by reference, and sets forth additional state standards. |
| 8. Missouri Hazardous Waste Management Law | Missouri Department of Natural Resources<br>RSMo 260.370, 260.390, and 260.395<br>10 CSR 25-7.264(2)(A) through (2)(G), (2)(K) through (2)(N), and/or (2)(S) | Sets forth the standards for owners and operators of hazardous waste treatment, storage and disposal facilities; incorporates and modifies the federal regulations in 40 CFR Part 264 by reference, and sets forth additional state requirements. |
| 9. Missouri Hazardous Waste Management Law | Missouri Department of Natural Resources<br>RSMo 260.370, 260.390, 260.395, and 260.400<br>10 CSR 25-7.268 | Establishes standards and requirements that identify hazardous wastes that are restricted from land disposal. |
| 10. Missouri Monitoring Well Construction Code | Missouri Department of Natural Resources<br>RSMo 256.603, 256.606, 256.626<br>10 CSR 23-4 | Specifies requirements for installation of groundwater monitoring wells. |
| 11. Missouri Well Construction Rules | Missouri Department of Natural Resources<br>RSMo 256.606, 256.626<br>10 CSR 23-3 | Specifies requirements for newly construction potable water wells from known contamination sources. |
| B. To Be Considered | None | |

Table 3-1
Alternative 3 - Low Permeable Cap, Sediment Excavation and Onsite Disposal,
Monitored Natural Recovery
Present Worth Cost Estimate
OU5 - Catherine Subsite

| Cost Estimate Component | Quantity | Units | Unit Cost | Capital Cost | O&M Cost |
|---|---|---|---|---|---|
| **CAPITAL COSTS** | | | | | |
| Mobilization/Demobilization | 1 | LS | $72,780 | $72,780 | |
| Clearing & grubbing | 10.9 | AC | $6,765 | $73,730 | |
| Excavate contaminated material from pond and move to repository | 2,900 | CY | $17 | $49,140 | |
| Soil confirmation sampling | 1 | LS | $14,784 | $14,780 | |
| Stabilization of Catherine Pond | 22,000 | FT | $2.21 | $48,630 | |
| Install low permeable cap at repository consisting 1 ft clay layer, 6 inch topsoil layer, and vegetation. | 52,756 | SY | $17.69 | $933,240 | |
| Install 8 ft chain link fence and signs around pond and repository | 4,100 | FT | $80 | $328,000 | |
| Deed Restrictions will be provided at no cost by local government | 1 | LS | $0 | $0 | |
| Install/abandon 4 - 20 ft deep GW monitoring wells | 1 | LS | $8,000 | $8,000 | |
| DIRECT CAPITAL COST SUBTOTAL | | | | $1,528,300 | |
| Bid Contingency (10%) | | | | $152,830 | |
| Scope Contingency (15%) | | | | $229,250 | |
| TOTAL DIRECT CAPITAL COST | | | | $1,910,380 | |
| Permitting and Legal (5%) | | | | $95,520 | |
| Construction Services (5%) | | | | $95,520 | |
| CONSTRUCTION COSTS TOTAL | | | | $2,101,420 | |
| Engineering Design (8%) | | | | $168,110 | |
| TOTAL CAPITAL COST | | | | $2,269,530 | |

Table 3-1
Alternative 3 - Low Permeable Cap, Sediment Excavation and Onsite Disposal,
Monitored Natural Recovery
Present Worth Cost Estimate
OU5 - Catherine Subsite

| Cost Estimate Component | Quantity | Units | Unit Cost | Capital Cost | O&M Cost |
|---|---|---|---|---|---|
| **ANNUAL OR PERIODIC O&M COSTS** | | | | | |
| **Maintenance & Repairs** | | | | | |
| Annual low permeable cap maintenance | 10.9 | AC | $947 | | $10,319 |
| Annual repair chain link fence | 1 | LS | $3,280 | | $3,280 |
| Replace signs every 5 years (thru Year 10) | 1 | LS | $445 | | $445 |
| **Sampling** | | | | | |
| Prepare Health & Safety Plan (Year 1 only) | 1 | LS | $3,200 | | $3,200 |
| Prepare QAPP/Sampling Plan (Year 1 only) | 1 | LS | $4,800 | | $4,800 |
| Semi Annual GW sampling (Yrs 1-2) at 4 wells | 1 | LS | $17,100 | | $17,100 |
| Annual GW sampling (Yrs 3-5) at 4 wells | 1 | LS | $8,550 | | $8,550 |
| Annual SW & sediment sampling (Yrs 1-10) at 3 locations | 1 | LS | $11,530 | | $11,530 |
| **Public Meetings & 5-Yr Reviews** | | | | | |
| Prepare Newsletter (Every 5 yrs) | 1 | LS | $4,000 | | $4,000 |
| Newsletter Publication & Local Newspaper (Every 5 yrs) | 1 | LS | $1,500 | | $1,500 |
| Public Information Mtg (Every 5 years) | 1 | LS | $4,600 | | $4,600 |
| 5 year review (Every 5 yrs) | 1 | LS | $25,000 | | $25,000 |
| TOTAL PRESENT WORTH O&M COST | | | | $384,010 | |
| TOTAL PRESENT WORTH | | | | $2,653,540 | |

7 percent discount rate used to calculate present worth.

LS - Lump Sum
AC - Acre
CY - Cubic Yards
FT - Feet
SY - Square Yards

Table 3-1 (Continued)
Alternative 3 - Low Permeable Cap, Sediment Excavation and Onsite Disposal,
Monitored Natural Recovery
Present Worth Cost Estimate
OU5 - Catherine Subsite

| Year | Yearly O&M Cost* | Intermittent O&M Costs | Total Annual O&M Costs | O&M Costs Include: |
|---|---|---|---|---|
| 1 | $42,229 | $8,000 | $50,230 | Cap Maintenance, Fence Repair, Sampling, QAPP/SAP, HASP. |
| 2 | $42,229 | | $42,230 | Cap Maintenance, Fence Repair, Sampling |
| 3 | $33,679 | | $33,680 | Cap Maintenance, Fence Repair, Sampling |
| 4 | $33,679 | | $33,680 | Cap Maintenance, Fence Repair, Sampling |
| 5 | $33,679 | $35,545 | $69,220 | Cap Maintenance, Fence Repair, Sign Repair, Sampling, 5-year Review. |
| 6 | $25,129 | | $25,130 | Cap Maintenance, Fence Repair, Sampling |
| 7 | $25,129 | | $25,130 | Cap Maintenance, Fence Repair, Sampling |
| 8 | $25,129 | | $25,130 | Cap Maintenance, Fence Repair, Sampling |
| 9 | $25,129 | | $25,130 | Cap Maintenance, Fence Repair, Sampling |
| 10 | $25,129 | $35,545 | $60,670 | Cap Maintenance, Fence Repair, Sign Repair, Sampling, 5-year Review. |
| 11 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 12 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 13 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 14 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 15 | $13,599 | $35,100 | $48,700 | Cap Maintenance, Fence Repair, 5-year Review. |
| 16 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 17 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 18 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 19 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 20 | $13,599 | $35,100 | $48,700 | Cap Maintenance, Fence Repair, 5-year Review. |
| 21 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 22 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 23 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 24 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 25 | $13,599 | $35,100 | $48,700 | Cap Maintenance, Fence Repair, 5-year Review. |
| 26 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 27 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 28 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 29 | $13,599 | | $13,600 | Cap Maintenance, Fence Repair |
| 30 | $13,599 | $35,100 | $48,700 | Cap Maintenance, Fence Repair, 5-year Review. |
| Total Costs of Annual O&M | | | $802,630 | |
| Present Worth of Annual O&M | | | $384,010 | |

Table 3-2
Alternative 4 - Low Permeable Cap, Excavation and Disposal, Monitored Natural Recovery
Present Worth Cost Estimate
OU5 - Skaggs Subsite

| Cost Estimate Component | Quantity | Units | Unit Cost | Capital Cost | O&M Cost |
|---|---|---|---|---|---|
| **CAPITAL COSTS** | | | | | |
| Mobilization/Demobilization | 1 | LS | $95,720 | $95,720 | |
| Clearing & grubbing assumed for East, Central, and West Chat areas | 12.2 | AC | $6,765 | $82,530 | |
| Excavate, dewater, and load sediment from 0.25 acre pond | 1,210 | SY | $1.79 | $2,160 | |
| Excavate and consolidate soil from East, West, and Central Chat Piles | 32,680 | CY | $10.90 | $356,300 | |
| Alt 4 soil confirmation sampling in eastern and western chat piles (7.7 acres) | 1 | LS | $10,349 | $10,350 | |
| Backfill, grading, and seeding eastern, western, and portion of central chat piles (7.7 acres) | 37,268 | SY | $25 | $920,880 | |
| Install low permeable cap consisting 1 ft clay layer, 6 inch topsoil layer, and vegetation (seeded). [Assumes 4.5 acres capped.] | 21,780 | SY | $17.69 | $385,280 | |
| Install 8 ft chain link fence and signage around capped area | 1,800 | FT | $80 | $143,640 | |
| Install signs along 2 Unnamed tributaries at 200 ft increments | 35 | EA | $148 | $5,200 | |
| Deed Restrictions will be provided at no cost by local government | 1 | LS | $0.00 | $0 | |
| Install/abandon 4 - 20 ft deep GW monitoring wells | 1 | LS | $8,000 | $8,000 | |
| | | | | | |
| DIRECT CAPITAL COST SUBTOTAL | | | | $2,010,060 | |
| Bid Contingency (10%) | | | | $201,010 | |
| Scope Contingency (15%) | | | | $301,510 | |
| TOTAL DIRECT CAPITAL COST | | | | $2,512,580 | |
| Permitting and Legal (5%) | | | | $125,630 | |
| Construction Services (5%) | | | | $125,630 | |
| CONSTRUCTION COSTS TOTAL | | | | $2,763,840 | |
| Engineering Design (8%) | | | | $221,110 | |
| TOTAL CAPITAL COST | | | | $2,984,950 | |

Table 3-2

Alternative 4 - Low Permeable Cap, Excavation and Disposal, Monitored Natural Recovery

Present Worth Cost Estimate

OU5 - Skaggs Subsite

| Cost Estimate Component | Quantity | Units | Unit Cost | Capital Cost | O&M Cost |
|---|---|---|---|---|---|
| **ANNUAL OR PERIODIC O&M COSTS** | | | | | |
| **Maintenance & Repairs** | | | | | |
| Annual low permeable cap maintenance | 4.5 | AC | $947 | | $4,260 |
| Annual repair chain link fence | 1 | LS | $1,440 | | $1,440 |
| Replace signs every 5 years (thru Year 10) | 1 | LS | $5,200 | | $5,200 |
| **Sampling** | | | | | |
| Prepare Health & Safety Plan (Year 1 only) | 1 | LS | $3,200 | | $3,200 |
| Prepare QAPP/Sampling Plan (Year 1 only) | 1 | LS | $4,800 | | $4,800 |
| Semi Annual GW sampling (Yrs 1-2) at 4 wells | 1 | LS | $17,100 | | $17,100 |
| Annual GW sampling (Yrs 3-5) at 4 wells | 1 | LS | $8,550 | | $8,550 |
| Annual SW & sediment sampling (Yrs 1-10) at 4 locations | 1 | LS | $10,750 | | $10,750 |
| **Public Meetings & 5-Yr Reviews** | | | | | |
| Prepare Newsletter (Every 5 yrs) | 1 | LS | $4,000 | | $4,000 |
| Newsletter Publication & Local Newspaper (Every 5 yrs) | 1 | LS | $1,500 | | $1,500 |
| Public Information Mtg (Every 5 years) | 1 | LS | $4,600 | | $4,600 |
| 5 year review (Every 5 yrs) | 1 | LS | $25,000 | | $25,000 |
| TOTAL PRESENT WORTH O&M COST | | | | $283,670 | |
| TOTAL PRESENT WORTH | | | | $3,268,620 | |

7 percent discount rate used to calculate present worth.

LS - Lump Sum

AC - Acre

SY - Square Yards

CY - Cubic Yards

FT - Feet

EA - Each

Table 3-2 (Continued)

Alternative 4 - Low Permeable Cap, Excavation and Disposal, Monitored Natural Recovery

Present Worth Cost Estimate

OU5 - Skaggs Subsite

| Year | Yearly O&M Cost | Intermittent O&M Costs | Total Annual O&M Costs | O&M Costs Include: |
|---|---|---|---|---|
| 1 | $33,550 | $8,000 | $41,550 | Maintenance & Repairs, Sampling, QAPP/SAP, HASP. |
| 2 | $33,550 | | $33,550 | Maintenance & Repairs, Sampling. |
| 3 | $25,000 | | $25,000 | Maintenance & Repairs, Sampling. |
| 4 | $25,000 | | $25,000 | Maintenance & Repairs, Sampling. |
| 5 | $25,000 | $40,300 | $65,300 | Maintenance & Repairs, Sampling, 5-year Review. |
| 6 | $16,450 | | $16,450 | Maintenance & Repairs, Sampling. |
| 7 | $16,450 | | $16,450 | Maintenance & Repairs, Sampling. |
| 8 | $16,450 | | $16,450 | Maintenance & Repairs, Sampling. |
| 9 | $16,450 | | $16,450 | Maintenance & Repairs, Sampling. |
| 10 | $16,450 | $35,100 | $51,550 | Maintenance & Repairs, Sampling, 5-year Review. |
| 11 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 12 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 13 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 14 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 15 | $5,700 | $35,100 | $40,800 | Maintenance & Repairs, 5-year Review. |
| 16 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 17 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 18 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 19 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 20 | $5,700 | $35,100 | $40,800 | Maintenance & Repairs, 5-year Review. |
| 21 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 22 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 23 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 24 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 25 | $5,700 | $35,100 | $40,800 | Maintenance & Repairs, 5-year Review. |
| 26 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 27 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 28 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 29 | $5,700 | | $5,700 | Maintenance & Repairs. |
| 30 | $5,700 | $35,100 | $40,800 | Maintenance & Repairs, 5-year Review. |
| Total Costs of Annual O&M | | | $562,150 | |
| Present Worth of Annual O&M | | | $283,670 | |